MECCANO® Magazine

DECEMBER 1968

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MAP

HOBBY MAGAZINE

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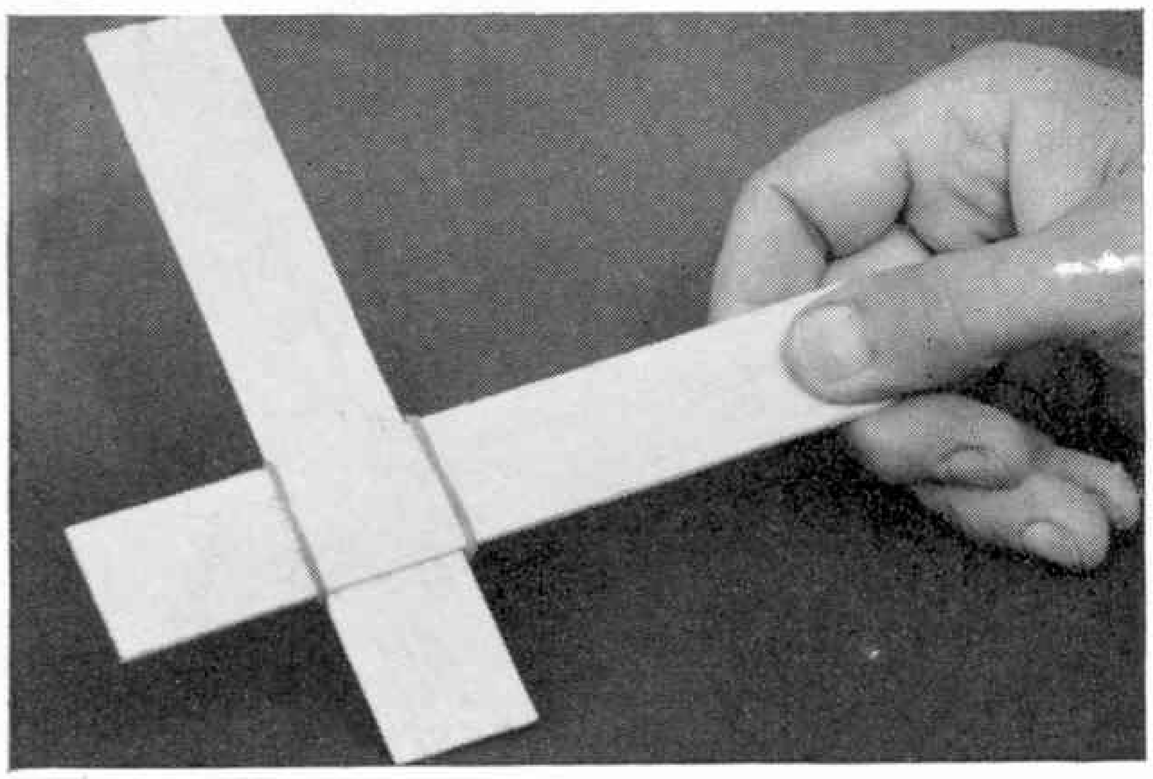

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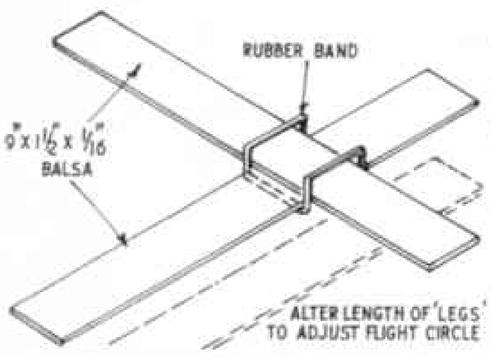

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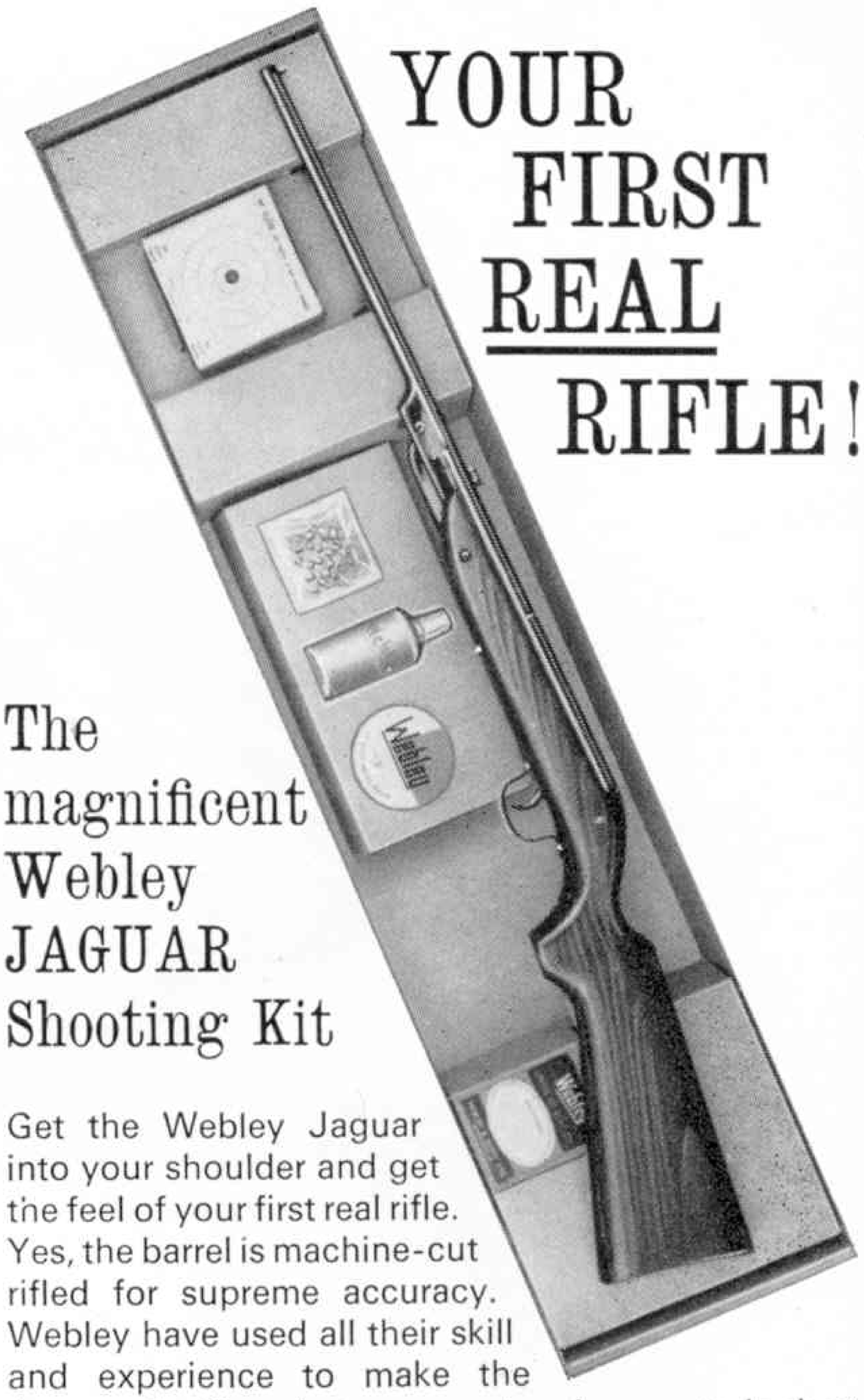

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MECCANO® Magazine

DECEMBER 1968 VOLUME 53 NUMBER 12

Meccano Magazine, founded 1916.

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JOHN FRANKLIN

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J. D. McHARD

Advertisement Manager
ROLAND SUTTON

MAP **HOBBY MAGAZINE**

FRONT COVER

A fairground Carousel—one of the most popular models produced specially for display work by Meccano Limited's Model-building Department. Although small, it is fully operational with revolving platform, prancing horses, and of course, plenty of coloured lights. It does its job as a display piece too, because it interested us so much that we wanted to feature it on the cover!

NEXT MONTH

January Meccano Magazine has extra editorial pages again and the exciting contents include a 5 transistor loud speaker radio for you to build with simple pin board construction. Meccano models include a Working Fairground Satelite for advance model builders, Among the Model Builders and a Meccano Clock feature. All the regulars such as Stamps, Battle, Great Engineers, Workbench and full size plans are included.

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CONTENTS

WORKBENCH 629
News and views by the Editor

MOBILE MORRIS IN MECCANO 630
A super working Meccano model

STAMPS IN THE BRITISH MUSEUM 634
The World's greatest stamp collection

METAL FATIGUE 638
Educational feature

MONORAILS 639
Last month's feature concluded

BATTLE 641
Part VIII—Anti tank guns

SIMPLE ELECTRONICS 642
An education kit review

BUILDING A RIKO CAR 644
Making a fast slot car

VINTAGE COMMERCIALS 646
Pre-war motors described

MILITARIA 647
A review by Charles Grant

HUMAN RIGHTS ON STAMPS 648
Stamps on a theme by J. A. Mackay

SPITFIRE VB 649
Full size indoor model plans

WORKING WITH PLASTICS 652
A new series for beginners

AMONG THE MODEL BUILDERS 654
Readers Meccano Ideas

READERS' LETTERS 656
A selection from the Editor's Mailbag

RECOMMENDED READING 657
Some interesting books reviewed

A.B.C. OF MODEL RAILWAYS 658
Bridges

SPRAY PAINTING FOR A SUPER FINISH 660
How to use an aerosol spray

THE 1911 NADGER 662
A simple Meccano model

SOME MODERN SHOWMANS TRACTORS 664
Ideal subjects for Meccano modelling

THE PRE-WAR MOTORS 666
Cars of the past described

AIR NEWS 667
John W. R. Taylor on Aviation

GREAT ENGINEERS 669
No. 11 Henry Ford

A WHIFF OF BYGONE TIMES 670
Two oldies in Meccano

BUILDING A BILLING BOAT 673
Boat kits reviewed

MODEL CARS

BUMPER CHRISTMAS ISSUE

FREE SCRUTINEERS HANDBOOK!

The Christmas number of Model Cars is something of a special in every respect; number of pages is 64 making this a pretty big issue and our Christmas present to readers takes the form of a 24 page book of Scrutineers dimensions on full size competition cars both old and new. A copy of this comes free with every Model Cars. A large 2 colour 24 advertiser's catalogue also free with every copy. Constructional features include a 1/24th scale Cooper Maserati, a radio controlled car, and a piece on chassis building from John Veasey while, for collectors, comes more Autominology and a piece on Australian micro models. Further highlights include features on painting clear body shells, a big report on a top class meeting, three 1/32nd scale plans for model racing cars and our usual complement of regulars together with a plastic kit review plus the return of the "Workout" series.

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MODEL BOATS

November issue is quite a number for championships—the British Open 'A' Class, National R/C Speed, and Scottish Marbleheads all having reports. For builders there is a 36 in. model of *Surfury* and a second article on tuned pipe exhausts. Drawings include a Spanish frigate of 1806, used in the R.N., Japanese icebreaker and destroyers, merchant ships *Clan Alpine* and *Europic Ferry*, and more Broads cruisers. Articles include a sailing model swimhead barge and a glass-case yawl.

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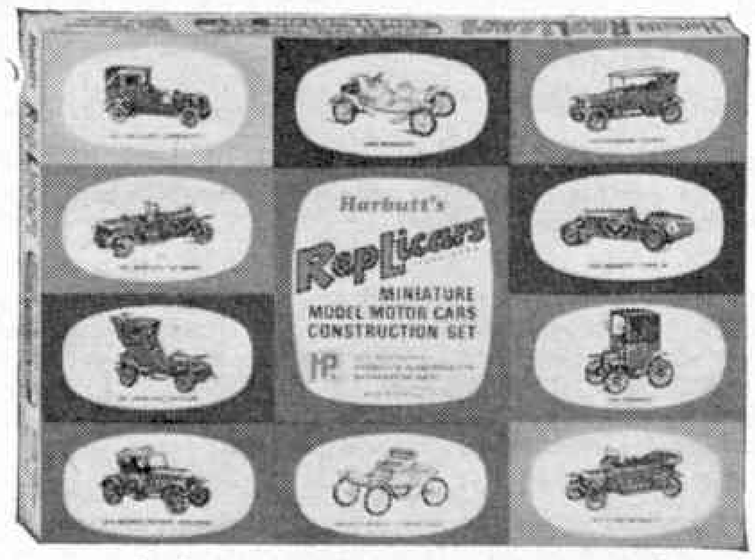

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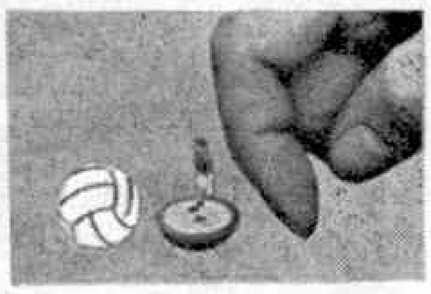

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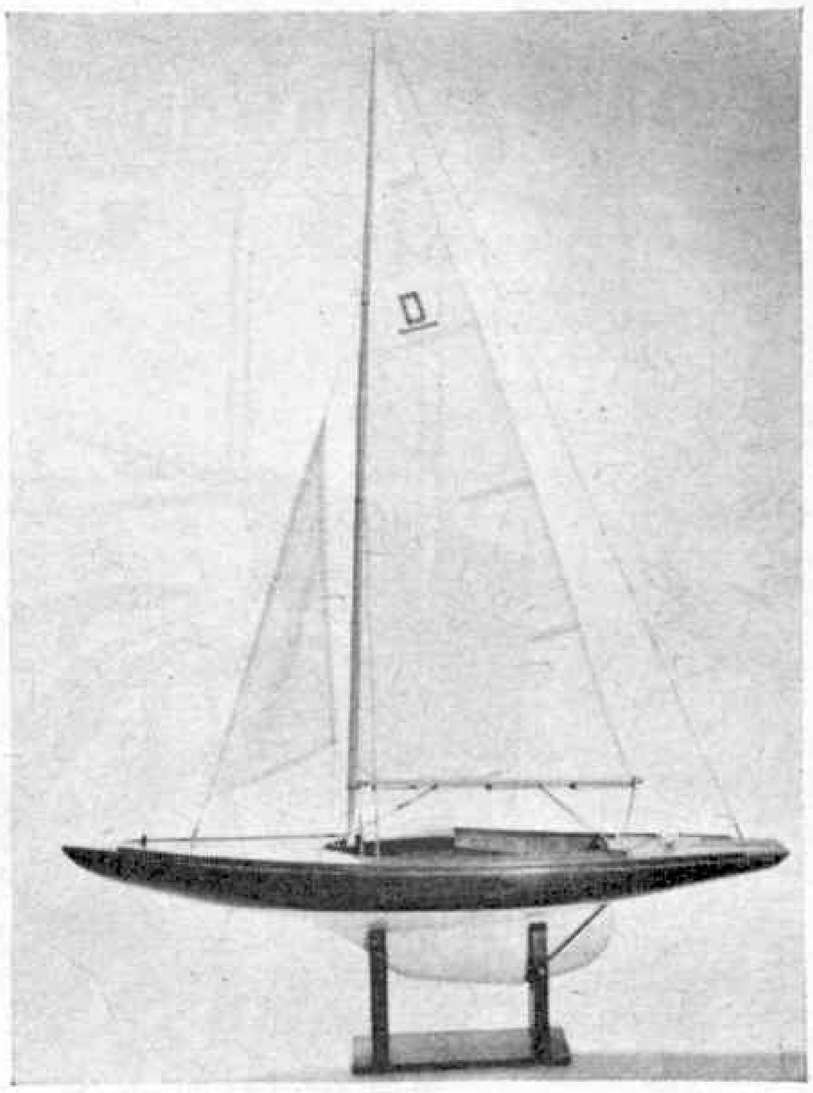

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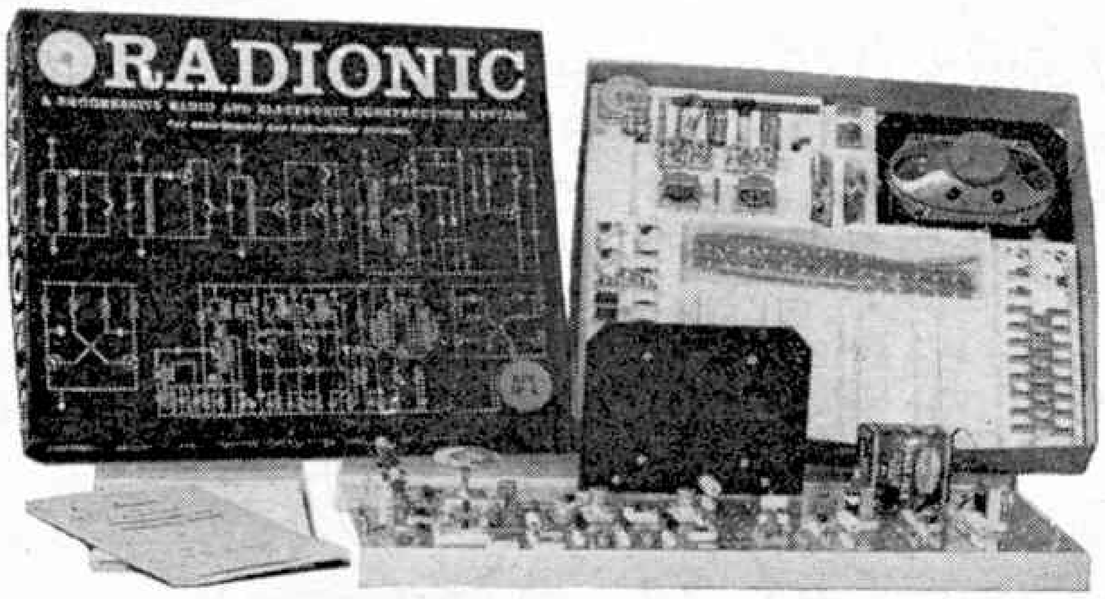

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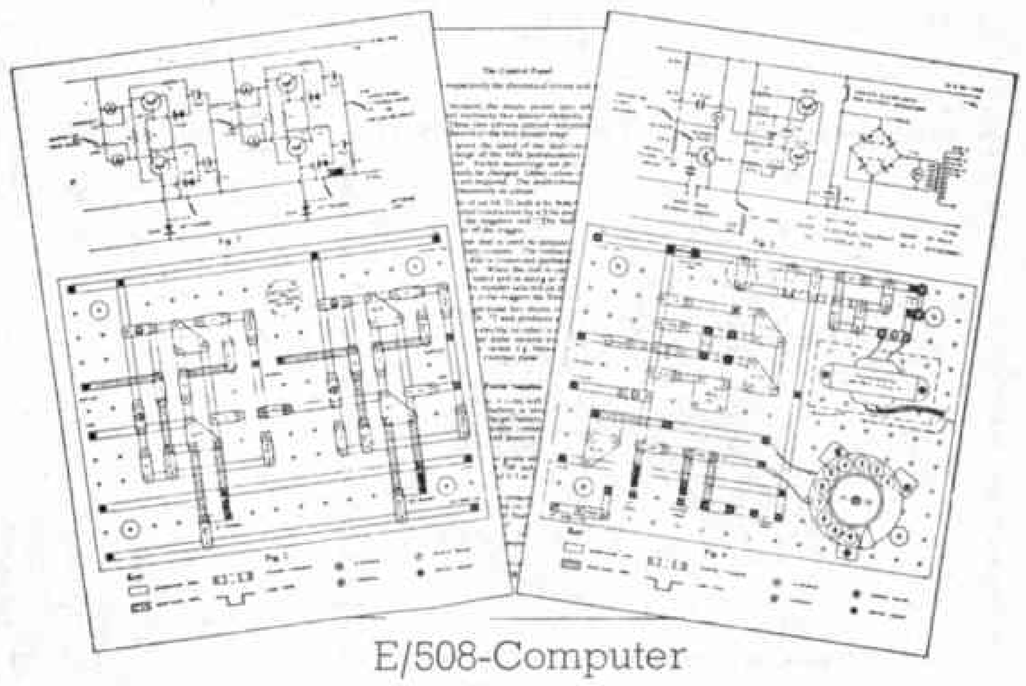

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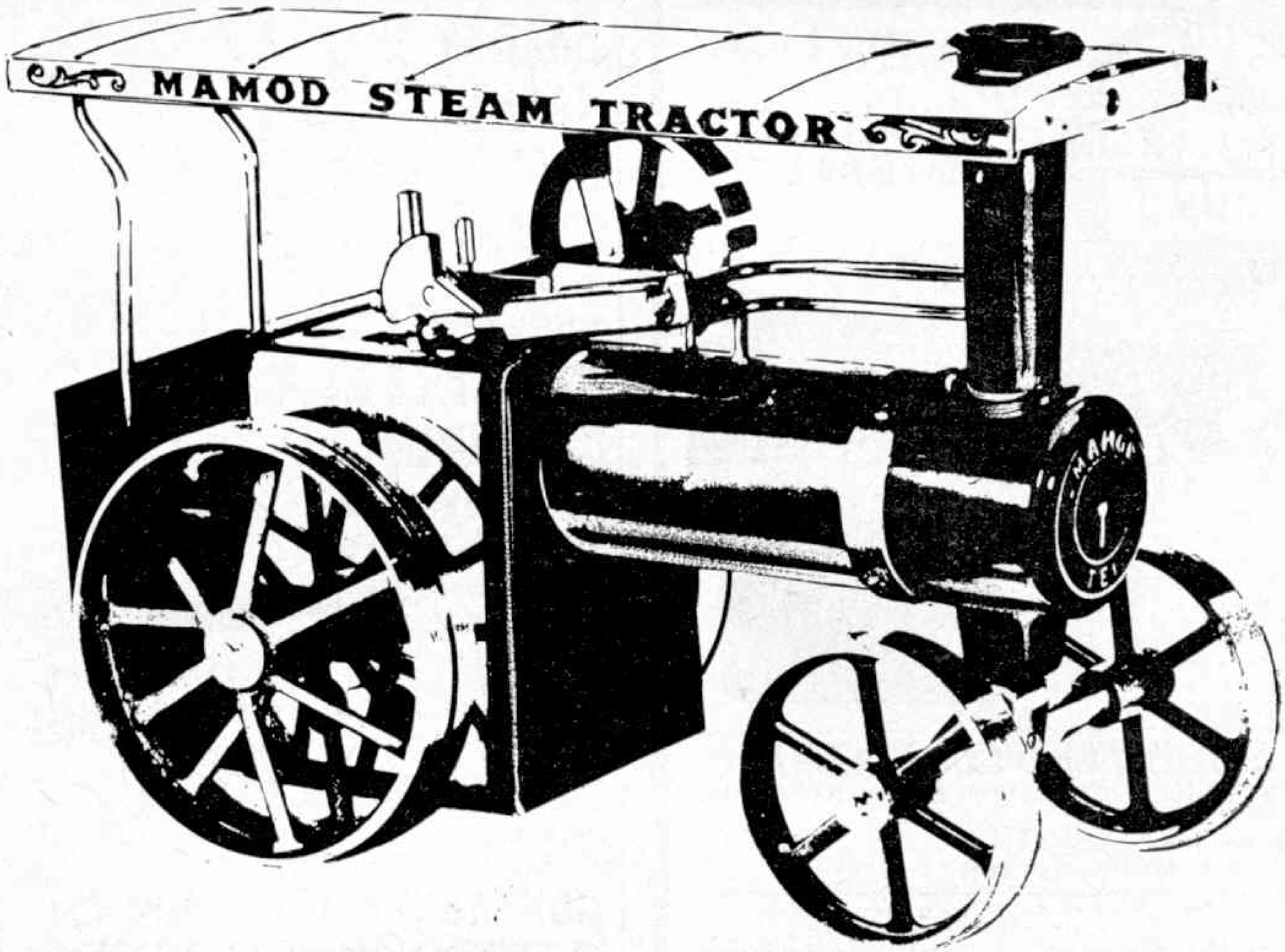

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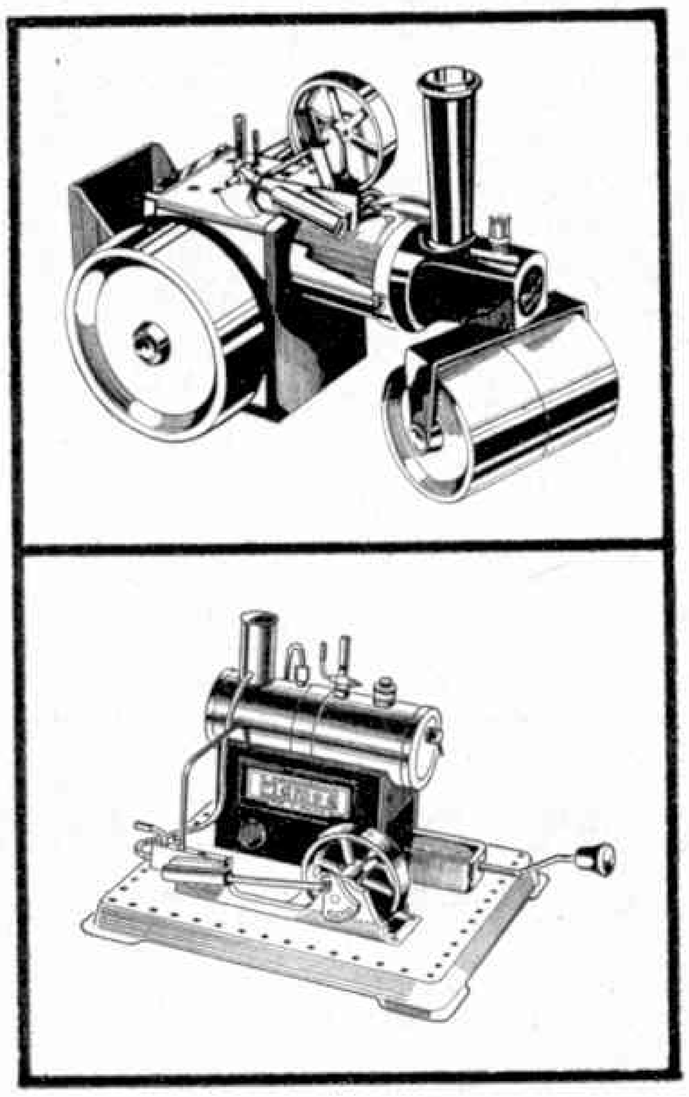
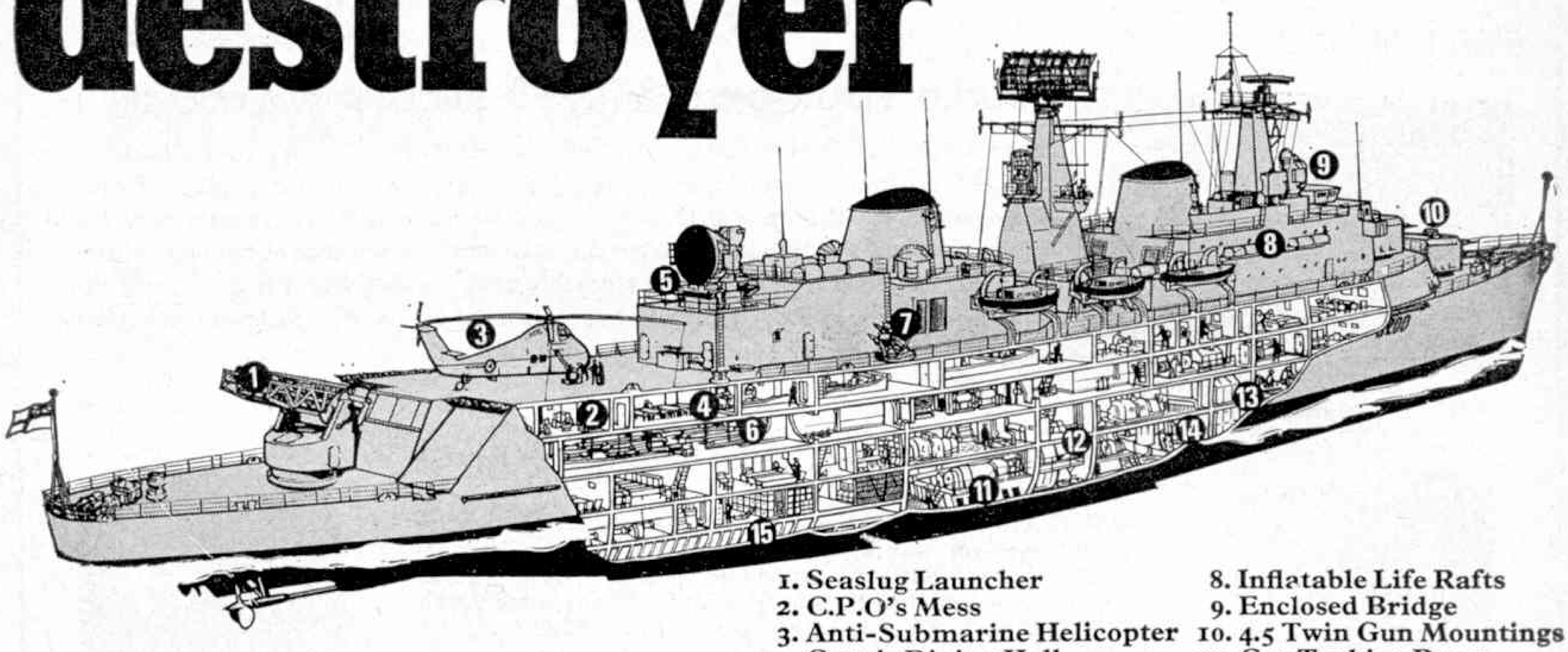


The missile-age destroyer



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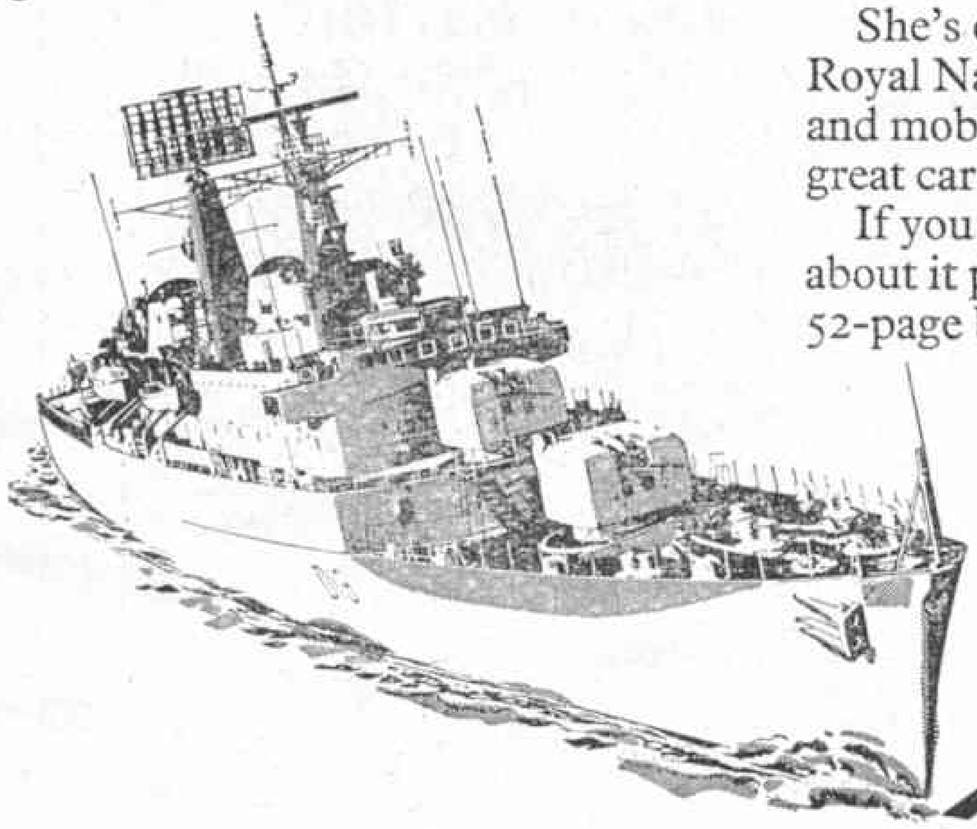

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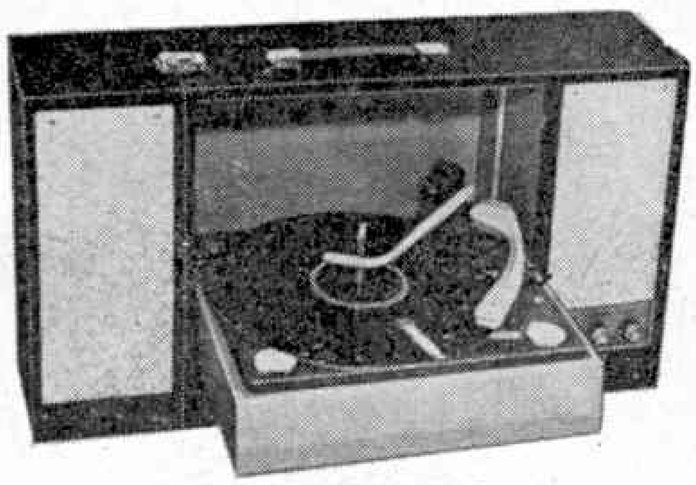

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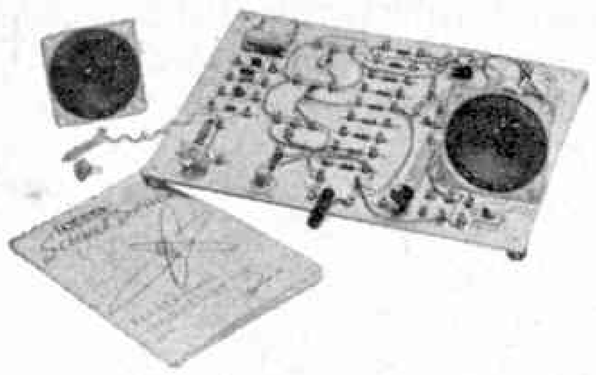

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Bumper Issue

WELL YOU lucky readers—here is a really bumper issue of *Meccano Magazine*—extra editorial pages and the super Meccano Magazine Booklet, all for just 6d. extra this month. It's been great fun preparing all the extra features, and poor old "Spanner" has really been burning the midnight oil in Liverpool on the Meccano section.

With this, the 12th issue of the new magazine from us here at M.A.P., time for a little reflection. No less than 680 pages have been published and several new series introduced—with more to come in '69. How did you like the last 12 issues? Your Editor would like to know your likes and dislikes, so please drop him a line—every letter no matter how short will be read with great interest to help decide our '69 policy. General correspondence seems to indicate that most readers are satisfied—but are you?

For those of you who keep each issue an index for 1968 will be available on January 1st. Subscribers will get one free of charge and other readers can purchase one for 1/- upon receipt of a postal order and large stamped addressed envelope.

Postal Subscriptions

In view of the recent change in postal arrangements a number of subscribers have either sent us additional money to ensure first-class delivery of their subscription copies or have enquired what method of despatch we are proposing to employ. All current subscriptions allow for 5d. per copy and therefore during the currency of their present subscriptions all readers with postal subscriptions will enjoy first-class delivery.

After we have had experience of the system for a few weeks we shall be able to gauge whether it is better to maintain subscription rates at their present level and deliver first-class or to offer a slight reduction and send second-class at the same time adjusting our despatch dates so that magazines arrive at the same time as before.

A further announcement will follow in due course.

Fifty Years Ago

It is not often that a reader's letter gets included in the editorial page, but as this one from Stuart H. Wilson will bring back such memories for old Meccano enthusiasts—we are making an exception.

Dear Sir,

H.T.M.C.

It is exactly fifty years on October 5th 1968 since the Holy Trinity Meccano Club (Barnsbury) was founded, and I was hoping to arrange for a re-union of all old members of this Club, but unfortunately the Parish Hall where we used to meet is not available now. As an alternative, if you or children are still interested in Meccano, etc., might I suggest you visit a unique exhibition at 56 Hameway, East Ham, E.6.

Here you will find several working models, and an assortment of parts (including rare and obsolete ones), manuals, outfits, Hornby Trains, Dinky Toys, etc., right from the days of "Mechanics Made Easy" (circa 1900) until the present time. It is FREE and well worth viewing—ask for best time to see it.

You will also find there several links with the Club, including photographs which will no doubt bring back memories.

I am now over seventy and have disposed of my own Meccano, mostly to Mr. P. Matthews, the owner of this display. My present hobby is Printing. I shall be glad to hear from you, or to receive a visit.

Did you see the last issue—July 1967—of the old "M.M."? It contained on pages 26-27, a reference to the Club by Mr. Ellison Hawks, one time Editor of the magazine, and Secretary of the Meccano Guild.

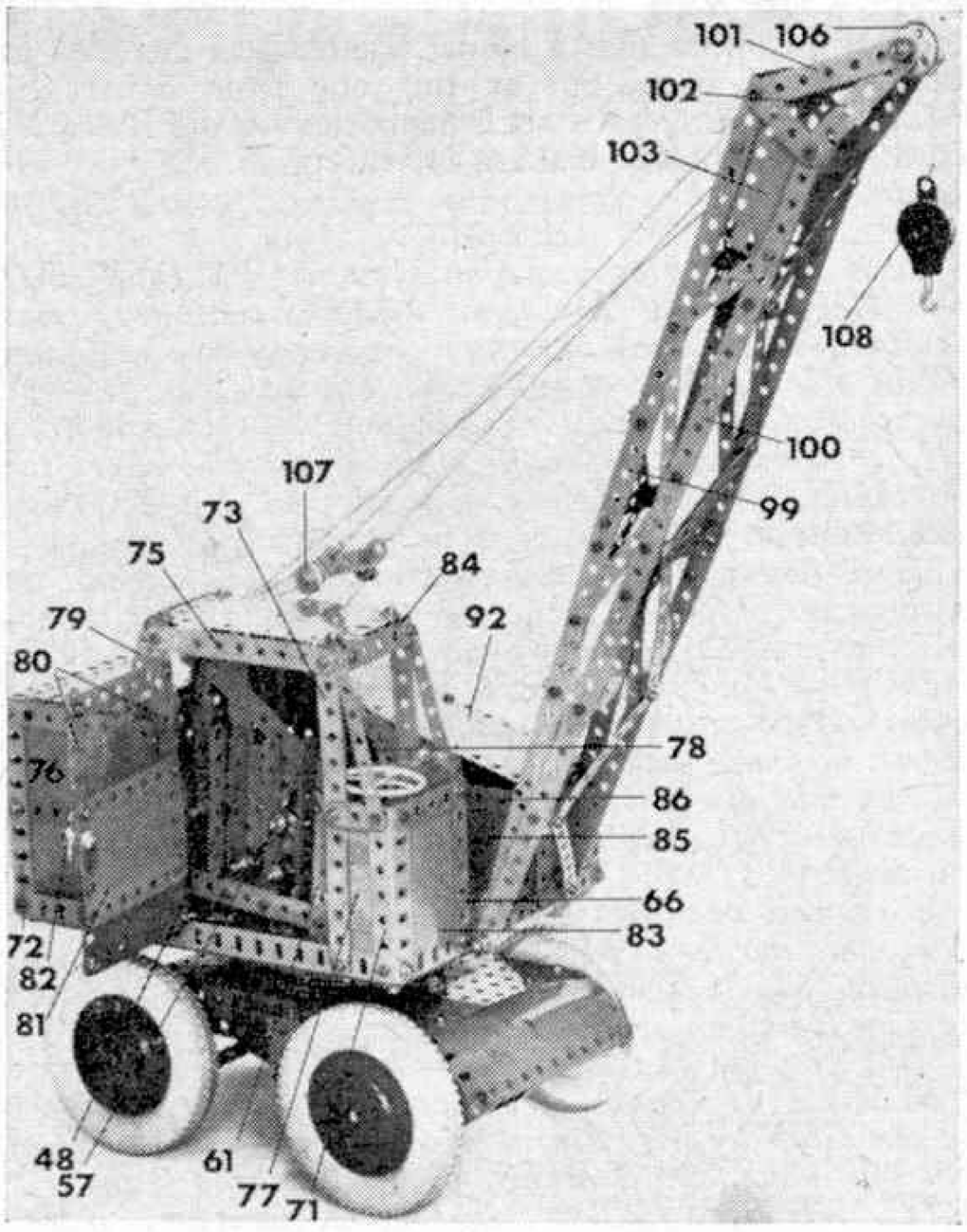
STUART H. WILSON, 12 Cypress Crescent, Horndean, Portsmouth, Hants. Tel: Horndean 8518.

Lucky Visitor

On Saturday, 14th September, the half millionth visitor passed through the World's Greatest Model Railway at the Montagu Motor Museum, Beaulieu.

The lucky visitor was Gavin Martin, aged 12 who has returned to England from the Bahamas to start at his new prep school at Gorse Hill, Boscombe.

Lord Montagu and his guest Michael Bentine were waiting at the pay box of the Model Railway to tell Gavin that he was the half millionth visitor and to present him with his own model railway set which was handed over by Michael Bentine. Mrs. L. Otto, owner of the Railway also presented Michael Bentine with a beautiful Fleischmann model train for his own son's model railway layout. Our picture below shows, left to right: Mrs. L. Otto, Michael Bentine, Gavin Martin, Lord Montagu.



This fully-operating Mobile Crane for advanced modellers is based on the Morris M120 crane produced by Herbert Morris Ltd., Loughborough, Leicestershire.

MOBILE MORRIS IN MECCANO

Spanner describes a comprehensive crane model for advanced builders.

WHEN OUR chief model-builder told me recently that he was working on a copy of a Morris, I naturally assumed that he was talking about one of the well-known range of cars made by B.M.C. You can imagine my surprise, therefore, when he eventually turned up with the large and detailed Mobile Crane featured here! I was beginning to wonder if one of us was going a little mad until I discovered that the model was in fact based on a Morris; not, however, a Morris produced by B.M.C. but a crane manufactured by Herbert Morris Ltd. of Loughborough, Leicestershire.

Before describing construction of the model, it is interesting to take a quick look at the full-size prototype, the Morris M120. This has all the classic lines of the typical "light" mobile crane with its four large wheels, compact body and long jib, although "light" is perhaps not the right word as it weighs something in excess of 13 tons and is capable of lifting a load of six tons to a height of 24½ ft. when fitted with the standard 25 ft. strut jib. Power for the hoisting operations, etc., comes from heavy-duty electric motors which draw their electricity from a generator in turn powered by a high-speed petrol or diesel engine. The crane will slew at 2½ r.p.m. and will travel over level ground at speeds up to 7 m.p.h. when unladen, and 3 m.p.h. with a full load. Overall width is 8 ft.

Turning now to the model, this is not built with any particular Outfit but, on the other hand, does not use any out-of-the-ordinary Parts. It is best to begin construction with the undercarriage. One flange of each of two 7½ in. Angle Girders 1 is extended by a 7½ in. Flat Girder 2, then the Angle Girders are connected by a 5½ in. Angle Girder 3 and two 5½ × 3½ in. Flat Plates 4 and 5, Plate 4 being placed crosswise. Attached by Angle Brackets to the ends of this Plate are two 5½ in. Flat Girders 6, bent as shown, the forward securing Bolts also holding two 2½ in. Stepped Curved Strips in position. The free ends of these Strips are joined by a 5½ × ½ in. Double Angle Strip 7, to which a shaped 5½ × 2½ in. Flexible Plate is bolted, the other side of this Plate being secured between Girder 3 and Plate 4. At the opposite end of the undercarriage, Girders 1 are extended by a further two 2½ in. Stepped Curved Strips, these joined by a 3½ × ½ in. Double Angle Strip 8. A shaped 3½ × 2½ in. Flexible Plate is bolted between this Double Angle Strip and Flat Plate 5.

Bolted to the top of Plates 4 and 5 is a Ball Thrust Race Toothed Disc held away from the Plates by Washers on the shanks of the securing Bolts. To ensure that the Disc is level, three Washers are carried by the long Bolts passing through the lower Plate, while only two Washers are added to the Bolt in the upper Plate. Journalled in the centre of the Toothed Disc and in Plate 5 is a 4½ in. Rod 9, held in place by a Collar beneath the Plate. A ½ in. Pinion 10, positioned above the Disc, is loose on the Rod, while a ¾ in. Pinion 11 is fixed lower down the Rod, to be followed by a loose Short Coupling 12, held in position by a Collar. Note that the Rod passes through one transverse bore of the Coupling.

Also journalled in the Toothed Disc and Flat Plate 5 (in holes adjacent to those carrying Rod 9) as well as in a Double Bent Strip 13 bolted to the underside of Plate 5, is a 2½ in. Rod. This is secured by a ½ in. Pinion 14, above the Disc, and by a Collar, the latter beneath Double Bent Strip 13. Pinion 14 meshes with Pinion 10, while a Crank 15 is mounted on the lower end of the Rod.

A 3½ × ½ in. Double Angle Strip 16, to which two Cranks 17 are fixed, is now bolted between Flat Girders 2, as shown, then a 1½ in. Rod is fixed in the boss of each Crank. Free to turn on the Rod is a Coupling 18, held in place by a Collar, the Rod passing through one end transverse bore of the Coupling. Another 1½ in. Rod is held in the longitudinal bore of the Coupling, a free-running 4¼ in. Road Wheel being secured on this Rod, again by a Collar. Fixed in the outside end tapped bore of the Coupling is a 1 in. Screwed Rod 19 the opposite end of which is screwed into a Threaded Boss. The Threaded Bosses at each side are then pivotally connected by a 5½ in. compound strip 20, the securing Bolt in one case also securing a bent 4 in. compound Strip 21, obtained from two 2½ in. Strips. The free end of this Strip is lock-nutted to Crank 15.

At the other end of the undercarriage an axle, complete with differential, is built up and mounted in two 1 in. Corner Brackets 22, bolted one to each Flat Girder 6. This differential axle arrangement is more or less the standard Meccano construction often included in various models: A 4 in. Rod 23, carrying,

In this view of the model, below right, the top of the body-work has been removed to show the construction of the gearbox. Bottom of page: In this close-up view, the construction of the differential is clearly shown.

in order, a Boiler End, a Collar, a 1½ in. Contrate Wheel 24, three Washers and a ¾ in. Contrate Wheel 25, is inserted, loose, part way into the longitudinal bore of a Coupling. (Large Contrate 24 is free on the Rod while small Contrate 25 is fixed. The Collar will later also be fixed to help secure the differential.) Loosely inserted part way into the other end of the longitudinal bore of the same Coupling is a 3 in. Rod 26, this carrying a second Boiler End and a fixed ¾ in. Contrate Wheel which meshes with two ¾ in. Pinions 27, free on Pivot Bolts screwed into the centre tapped bores of the Coupling. A 1½ in. Rod is fixed in the centre transverse smooth bore of the Coupling, and Collars fixed on opposite ends of this Rod are connected to Contrate 24 by 1 in. Screwed Rods 28.

The Boiler Ends are then joined by four 2 in. Strips, one of which, numbered 29 in the illustrations, is spaced from the Boiler Ends by two Washers on each securing Bolt. Attached to this Strip is a Double Bent Strip 30, the two Parts between them serving as the bearings for a 2 in. Rod held in place by a ½ in. Pinion 31 and a Collar. Pinion 31 engages with Contrate 24. A ¾ in. Contrate 32 is fixed on the Rod, the free end of which is inserted into the longitudinal bore of Short Coupling 12. Contrate 32 engages with Pinion 11. Large Road Wheels are of course mounted on Rods 23 and 26.

Body and gearbox

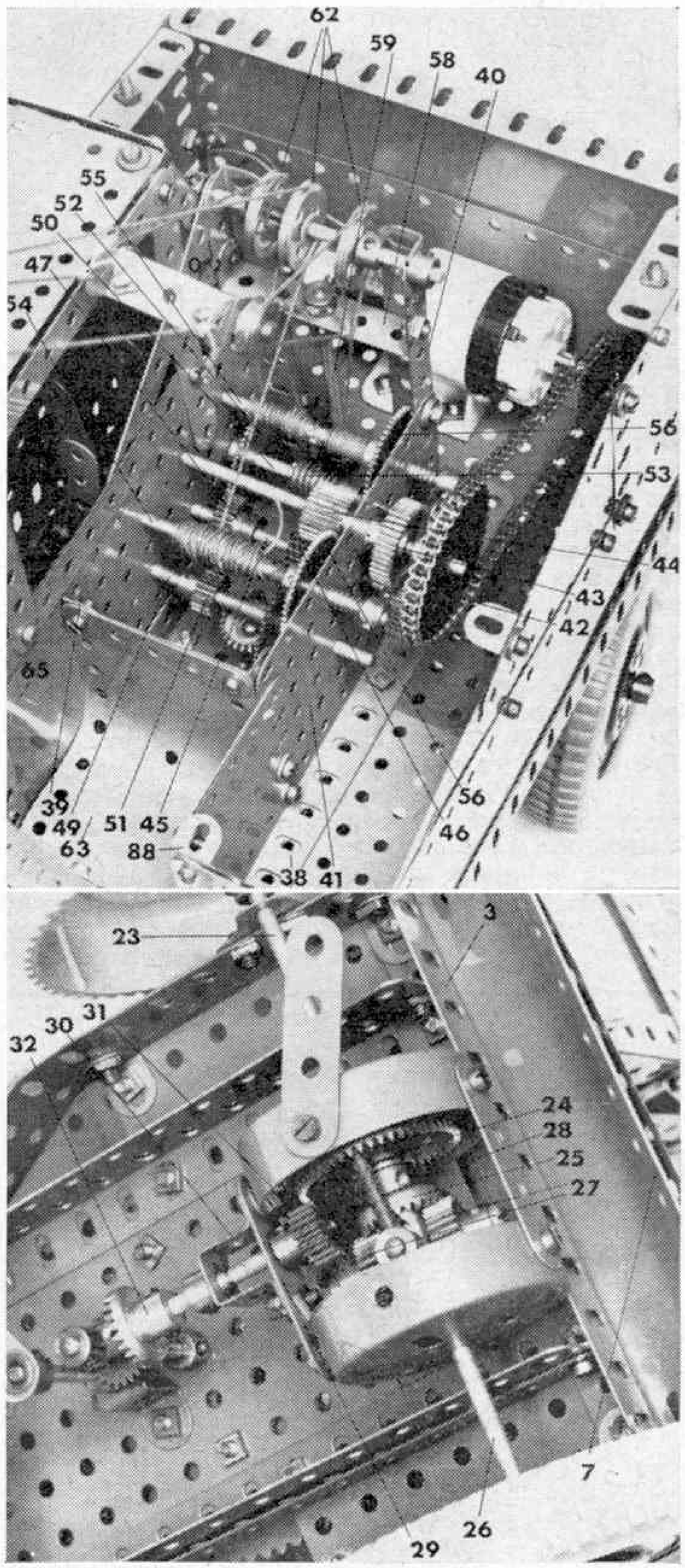
Moving on now to the body, a base framework is built up from two 9½ in. Angle Girders 33 joined by two 7½ in. Angle Girders 34, the resulting rectangle being enclosed by two 5½ x 2½ in. Flat Plates 35, two 4½ × 2½ in. Flat Plates 36 and two 5½ × 3½ in. Flat Plates 37.

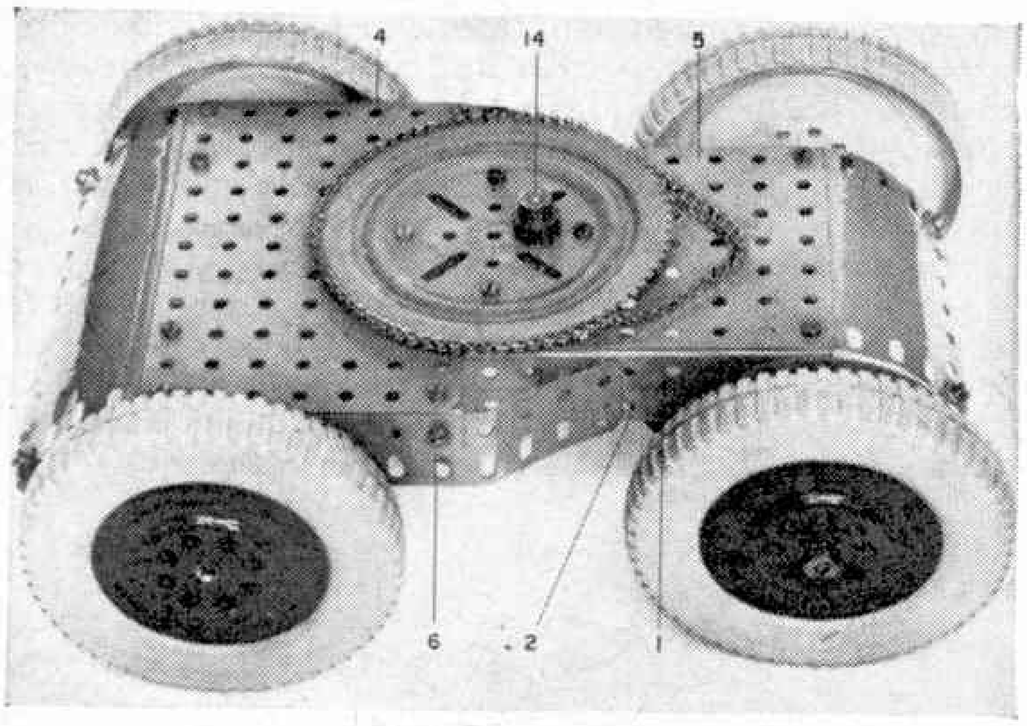
At this stage, while there is plenty of room available, the gearbox should be added. Two 7½ in. Angle Girders 38, placed longitudinally, are bolted one through the fifth hole and one through the eleventh hole of front Angle Girder 34, also, of course, being bolted to the tops of the base Flat Plates. One 3 in. Angle Girder 39 and one 5½ in. Angle Girder 40 are fixed to each Girder 38. then these two Girders are connected by a 4½ × 2½ in. Flat Plate 41.

Journalled in Flat Plates 41 is a 4 in. Rod which carries, outside the Plates, a 2½ in. Sprocket Wheel 42 and a 1 in. Gear 43, while a ¾ × ½ in. Pinion 44 is mounted on the Rod inside the Plates. Gear 43 meshes with another 1 in. Gear on a 4½ in. Rod 45, journalled in Plates 41 vertically below the 4 in. Rod. Mounted on Rod 45 are a ¾ × ¾ in. Pinion 46 and a ¾ × ¼ in. Pinion 47. The Rod, incidentally, is free to slide in its bearing, controlled by a 3½ in. Strip 48, lock-nutted to one lug of a 1 × ½ in. Double Bracket bolted to the base. A Bolt in the second hole of this Strip is screwed into one bore of a loose Collar held on Rod 45 by two other fixed Collars placed one each side. A Nut on the shank of the Bolt prevents it from fouling the Rod.

Rod 45 is flanked on one side by a second sliding 4½ in. Rod 49, similarly controlled, and, on the other by a non-sliding 3½ in. Rod 50. Mounted on Rod 49 are a ½ in. Pinion 51 and a 50-teeth Gear, the latter in constant mesh with Pinion 46, while, a 50-teeth Gear 52 is also mounted on Rod 50 along with a Worm Gear 53.

Returning to Rod 42, this is flanked by two 4½ in. Rods 54 and 55, one each side. Both Rods carry a 50-teeth Gear Wheel 56 and both are free to slide in their bearings, too much movement being prevented by a Collar on one end of each Rod and a 1 in. Pulley with Rubber Ring 57 on the other end. A Compression Spring is mounted on each Rod between the Collar and Plate 41, the action of the Spring on the rod thus forcing Pulley with Rubber Ring 57 against its respective Plate 41 to serve as a brake for the winding drum, Rods 54 and 55 later acting as the winding drums, one for the jib and one for the load hook. Movement of both Rods is controlled by levers similar to those already mentioned, although, of course, the positions of the locating Bolts in the 3½ in. Strips are different.





The undercarriage of the Crane as it appears when removed from the body of the model.

Angle Girders 40 at each side are now joined by a $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip 58. Journalled in this and in the base Flat Plates is a $5\frac{1}{2}$ in. Rod carrying a $\frac{1}{2}$ in. Pinion, in constant mesh with Worm 53, and a $\frac{3}{4}$ in. Sprocket Wheel 60, the latter on the lower end of the Rod, which is held in place by Collars. A Power Drive Unit is then bolted to the base Flat Plates in the position shown, and a 1 in. Sprocket on its output shaft is connected by Chain to Sprocket 42. A lever controlling the motor switch is built up from a 3 in. Strip 61, lock-nutted to an Angle Bracket bolted to Girder 33. Lock-nutted, in turn, through the second hole of this Strip is a 7 in. compound strip, the other end of which is held by a Collar on an Adaptor for Screwed Rod. This is accordingly fixed by a Bolt to a $2\frac{1}{2}$ in. Strip lock-nutted to the long lug of a $1 \times \frac{1}{2}$ in. Angle Bracket bolted to the base. A Slide Piece fixed through the second hole from the top of this $2\frac{1}{2}$ in. Strip fits over the motor switch.

Next, a bracing $5\frac{1}{2}$ in. Strip is fixed between each Flat Plate 41 and corresponding Angle Girder 40, being attached to the latter by a $3\frac{1}{2}$ in. Rod carrying three 1 in. loose Pulleys 62 and held in place by Collars. The front of the gearbox is then enclosed by a shaped $4\frac{1}{2} \times 2\frac{1}{2}$ in. Plastic Plate 63 edged at the top by a $2\frac{1}{2}$ in. Strip and bolted to Angle Girders 39. At the bottom, the Plate is bolted to front Girder 34, the securing Bolts also fixing a $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip 64 to the Girder, although the latter are spaced apart by two Washers on the shank of each Bolt.

PARTS REQUIRED

8—1a	1—16b	4—52a	1—151
5—2	6—18a	4—53a	2—155
6—2a	2—22	1—55a	1—168
9—3	5—22a	34—59	1—173a
4—4	2—23	4—62	1—180
12—5	4—25	1—62b	1—185
4—6	1—25a	3—63	4—187b
3—6a	1—25b	2—64	4—188
2—8a	6—26	2—70	2—190
7—8b	4—27	38—72	4—190a
3—9	1—28	4—82	3—191
2—9a	4—29	4—90a	1—192
2—9b	2—21	1—94	1—193a
2—9c	1—32	1—95	1—193b
2—9d	49—37	1—96	1—194c
4—11	207—37a	1—96a	4—195
2—11a	180—37b	2—103	1—196
25—12	9—38	2—103k	2—224
1—12b	3—45	6—111a	1—226
1—14	4—48	4—111c	4—235
6—15a	5—48a	2—120	6—235a
2—15b	2—48b	2—120b	13—235b
3—16	1—48d	2—133a	2—235d
1—16a	1—50		

1—Power Drive Motor

Body

Having now completed the gearbox, the body can be dealt with. The inner of the cab sides consists of existing Flat Plate 41 extended forward by a $3\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 65 bolted to a $3\frac{1}{2}$ in. Girder 66 fixed to front Girder 34. Bolted to the top of Girder 66 is a $5\frac{1}{2}$ in. Strip to which, in turn, are bolted a $3\frac{1}{2}$ in. Narrow Strip 67, a $3\frac{1}{2}$ in. Strip 68 and a $4\frac{1}{2}$ in. Strip 69. Another $4\frac{1}{2}$ in. Strip is used to connect the tops of Strips 68 and 69, at the same time fixing two Angle Brackets 70 and two $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strips in place. The cab roof will later be attached to these Double Angle Strips.

Turning to the outer side of the cab, one $3\frac{1}{2}$ in. Angle Girder 71 and one $4\frac{1}{2}$ in. Angle Girder 72, along with two $6\frac{1}{2}$ in. compound strips 73 and 74, are fixed to Angle Girder 33 in the positions shown. Compound strip 73 consists of a $5\frac{1}{2}$ in. Strip extended by a $3\frac{1}{2}$ in. Strip, while compound strip 74 is a $5\frac{1}{2}$ in. Strip extended by a $2\frac{1}{2}$ in. Strip. The tops of the two compound strips are connected by a $4\frac{1}{2}$ in. Strip 75, while Strip 74 is connected to Girder 72 by a second $4\frac{1}{2}$ in. Strip. Strip 73 is connected to Girder 71 by a $1\frac{1}{2}$ in. Strip. In the first case, the intervening space is enclosed by two $4\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plates 76, whereas, in the latter case, two $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plates 77, suitably overlapped, are used. A $3\frac{1}{2}$ in. Narrow Strip 78 and a $2\frac{1}{2}$ in. Narrow Strip 79 are added, as shown, to both sides of the cab to round-off the structure.

A door is produced from two $5\frac{1}{2}$ in. Strips 80 joined by three $3\frac{1}{2}$ in. Strips, the resulting space being covered by a $3\frac{1}{2} \times 2\frac{1}{2}$ in. Transparent Plastic Plate and a $3\frac{1}{2} \times 3\frac{1}{2}$ in. compound flexible plate 81, built up from two $3\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plates. The door is attached to compound strip 74 by Hinges, a doorcatch 82 being supplied by a Handrail Support in which a 1 in. Rod is fixed. A Fishplate is held by Nuts on the shank of the Handrail Support.

At the front of the cab, Girders 66 and 71 are joined by a $3\frac{1}{2}$ in. Strip and a $3\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 83, extended by a $3\frac{1}{2} \times 2\frac{1}{2}$ in. Transparent Plastic Plate, the latter edged by a $2\frac{1}{2}$ in. Strip 84, bolted to front Angle Brackets 70. Attached to rear Angle Brackets 70 and to a $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip bolted between Girder 40 and the $4\frac{1}{2}$ in. Strip joining Parts numbered 74 and 75, is a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Transparent Plastic Plate, edged at the top and bottom by $2\frac{1}{2}$ in. Strips. The cab roof is supplied by a $4\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate bolted to the Double Angle Strips used to connect the tops of Strips 68 and 69 at each side.

At the other side of the gearbox, Flat Plate 41 is extended forward by a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 85, edged by a $2\frac{1}{2}$ in. Strip 86 and bolted to a $2\frac{1}{2}$ in. Angle Girder fixed to front Girder 34. Another $2\frac{1}{2}$ in. Angle Girder 87 is fixed to Girders 33 and 34, then the two are joined by a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate edged by $2\frac{1}{2}$ in. Strips, the Bolts securing the top Strip also holding two Obtuse Angle Brackets 88 in place. A $4\frac{1}{2}$ in. Angle Girder 89 is bolted to the rearmost end of Girder 33, then the side is filled in with a $9\frac{1}{2} \times 2\frac{1}{2}$ in. Strip Plate 90, a $3\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 91 and two $3\frac{1}{2} \times 2\frac{1}{2}$ in. Triangular Flexible Plates. A 2 in. Angle Girder is bolted to Plate 91, which is also attached to appropriate Angle Girder 40 by a $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip. Bolted to this Double Angle Strip and to Obtuse Angle Brackets 88 is a $7\frac{1}{2} \times 2\frac{1}{2}$ in.

Strip Plate 92, while another $7\frac{1}{2} \times 2\frac{1}{2}$ in. Strip Plate is bolted between the 2 in. Angle Girder and another similar Angle Girder secured to upper Plate 76.

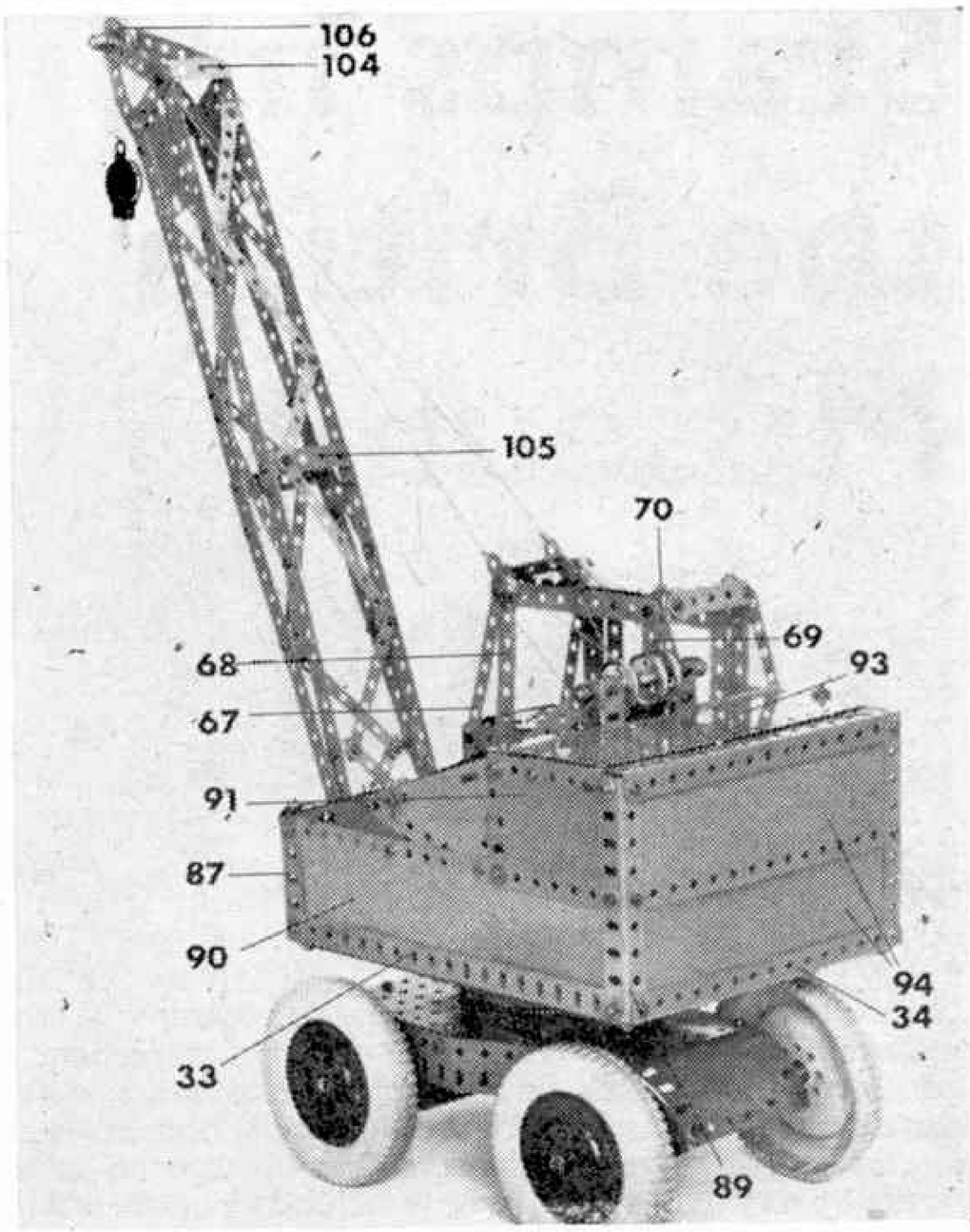
At the back, a $7\frac{1}{2}$ in. Angle Girder 93 is bolted between the tops of Girders 89 and 72, the resulting space being enclosed by two $7\frac{1}{2} \times 2\frac{1}{2}$ in. Strip Plates 94.

Before the body is fixed on the undercarriage, a Steering Wheel is mounted on a 4 in. Rod 95, journalled in the appropriate Flat Plate 36 and in a Double Bent Strip bolted to the top of the Plate. It is held in place by a Collar above the Double Bent Strip and a Crank 96 beneath the Plate.

Now fixed by four Double Brackets to the underside of Flat Plates 37 is a Ball Thrust Race Flanged Disc 97. Journalled in this Disc and the appropriate Flat Plate is a $1\frac{1}{2}$ in. Rod held in place by a $\frac{1}{2}$ in. Pinion 98 beneath the Disc and by a Double Arm Crank above it. A $3\frac{1}{2}$ in. Narrow Strip is lock-nutted to one arm of this Crank and also to the arm of Crank 96, then the completed body is mounted on the undercarriage by passing Rod 9 up through the centre hole of Flanged Disc 97 and through the Flat Plate, after which it is secured by a Collar above the Plate. Of course, a Ball Cage is first added between the two Flanged Discs to complete the Ball Thrust Race. A length of Sprocket Chain is passed round Sprocket Wheel 60 and round the Ball Thrust Race Toothed Disc. A $\frac{3}{4}$ in. Contrate Wheel is fixed on the upper end of Rod 9 to engage with Pinion 51, thus completing the drive linkage to the undercarriage road wheels.

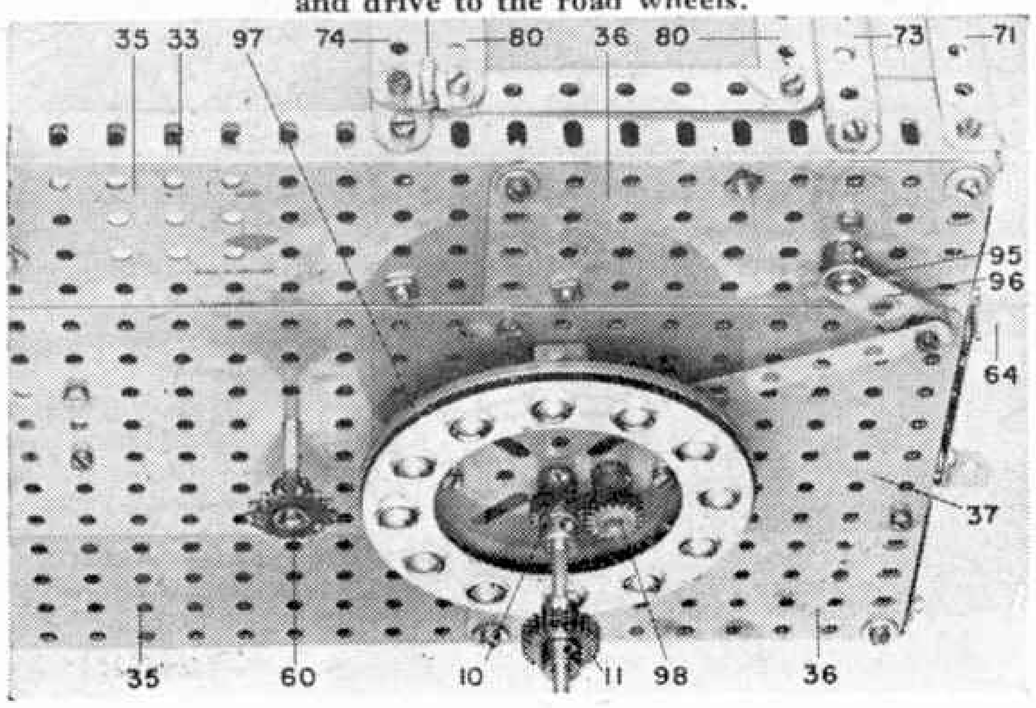
With the body in position, Pinion 98 should engage with Pinion 10 which in turn meshes with Pinion 14 to complete the steering linkage.

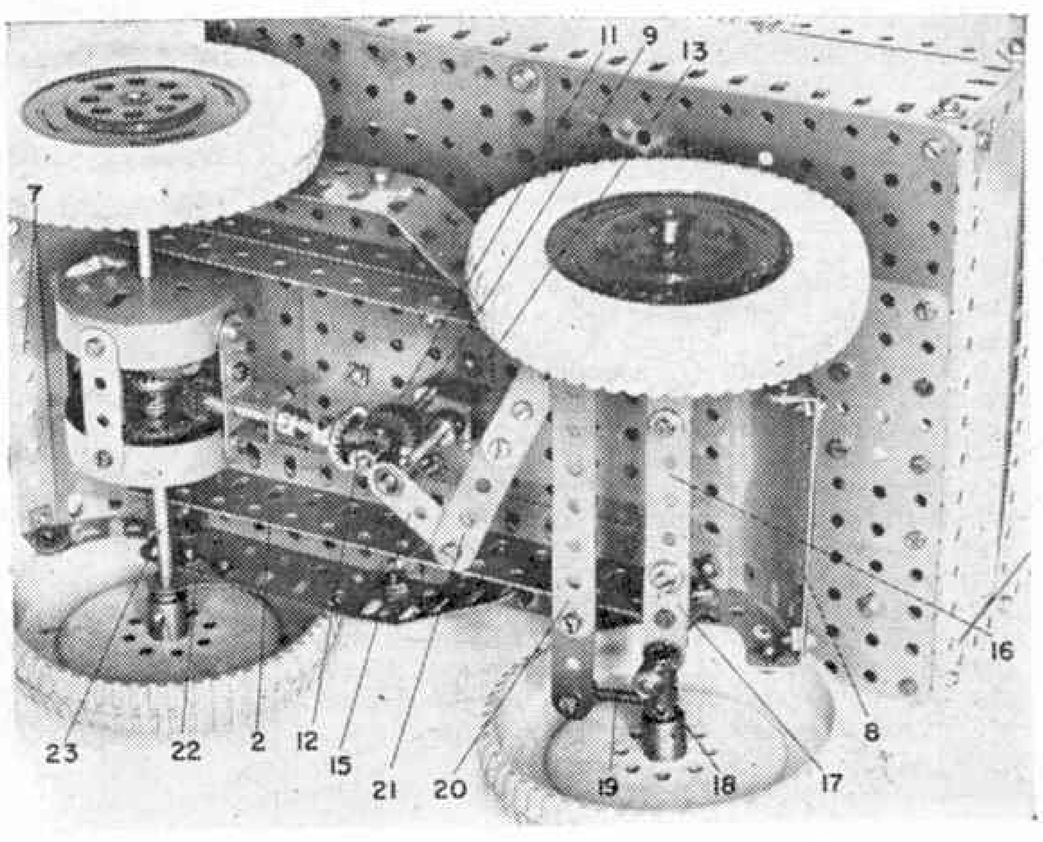
All that now remains to be built is the jib which consists of two identical "sides," each built up from two $17\frac{1}{2}$ in. compound strips 99 and 100 braced by various Narrow Strips, as shown. Each compound strip is made up from two $9\frac{1}{2}$ in. Strips overlapped two holes, the compound strips, themselves, being joined at their upper ends by a 2 in. Strip, at the same time fixing a $3\frac{1}{2}$ in. Strip 101 and a 3 in. Strip 102 in place. A $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 103 is added, then the sides are connected, at their upper ends by two $1\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strips 104 and, approximately half-way down, by two 2 in. Strips 105, attached by Angle Brackets. Strips 102 and 103 are brought together and in their end holes is journalled a $1\frac{1}{2}$ in. Rod carrying two 1 in. loose Pulleys 106 and held in place by Collars. The completed jib is then attached to the lugs of Double Angle Strip 64 by a $3\frac{1}{2}$ in. Rod also held by Collars.



We come now to the control cords, although, first, an intermediate pulley system for the jib is built up from two $1\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strips, joined together, with two $\frac{1}{2}$ in. loose Pulleys 107 being mounted on $\frac{3}{8}$ in. Bolts held by Nuts in the lugs of one of the Strips. Two equal lengths of Cord are tied to the lugs of the remaining Strip, their other ends being tied to points near the top of the jib. A further two equal lengths of Cord are tied to Double Angle Strip 58, are passed round Pulleys 107, and are brought back and over the two outside Pulleys 62 to be finally wound on Rod 55. A final length of Cord is tied to the lug of a Single Pulley Block 108, is taken over one Pulley 106, is brought down and around the Pulley in the Block and is then taken up and over remaining Pulley 106. From there it is taken down and around centre Pulley 62 to be wound on Rod 54, thus completing the model.

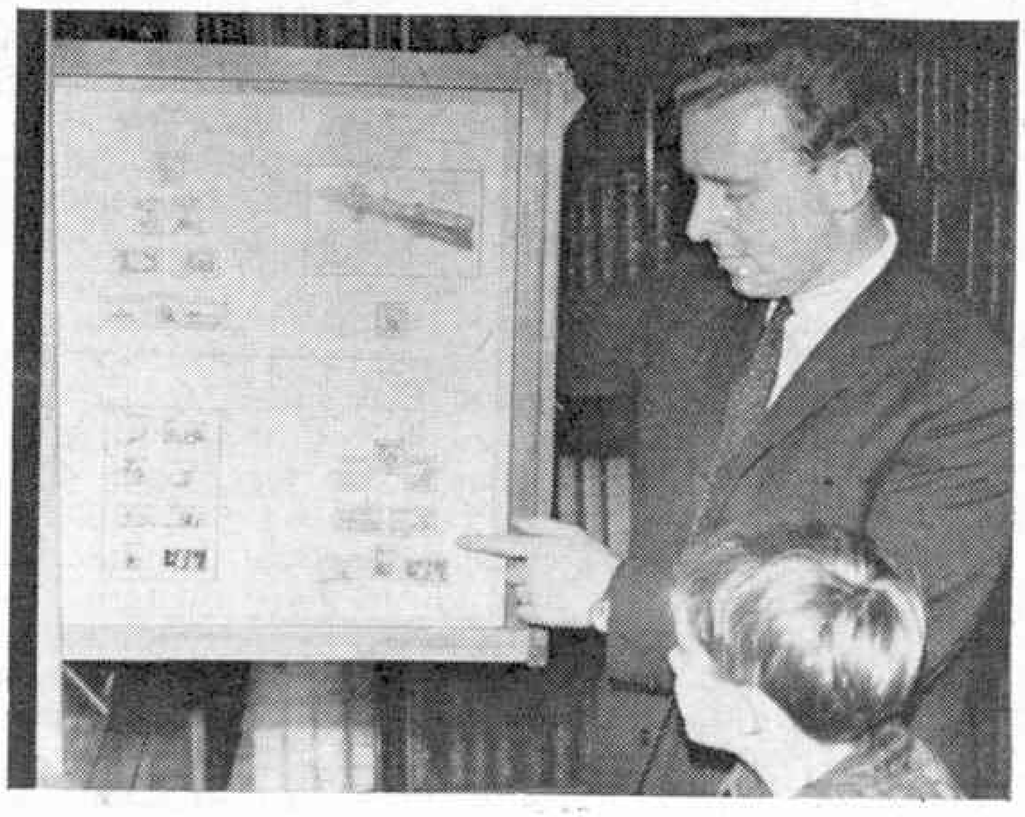
Below: An underside view of the body when removed from the undercarriage. Note that, when the body is in place, Pinion 11 is situated beneath the undercarriage. At right: An underside view of the model showing the steering linkage and drive to the road wheels.





Stamps in the British Museum

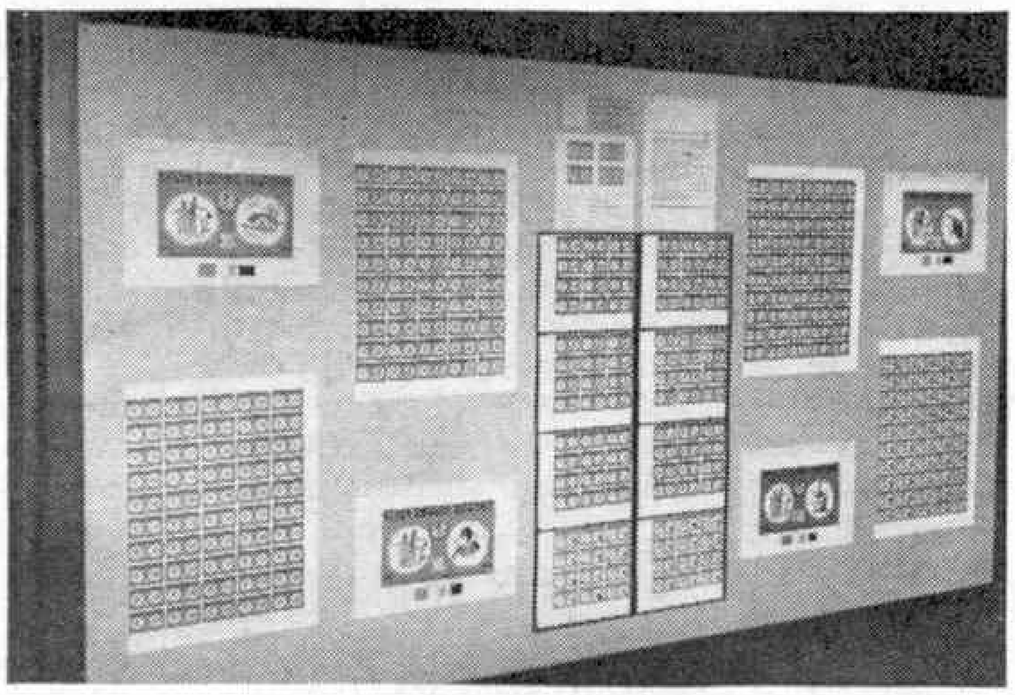
By James A. Mackay

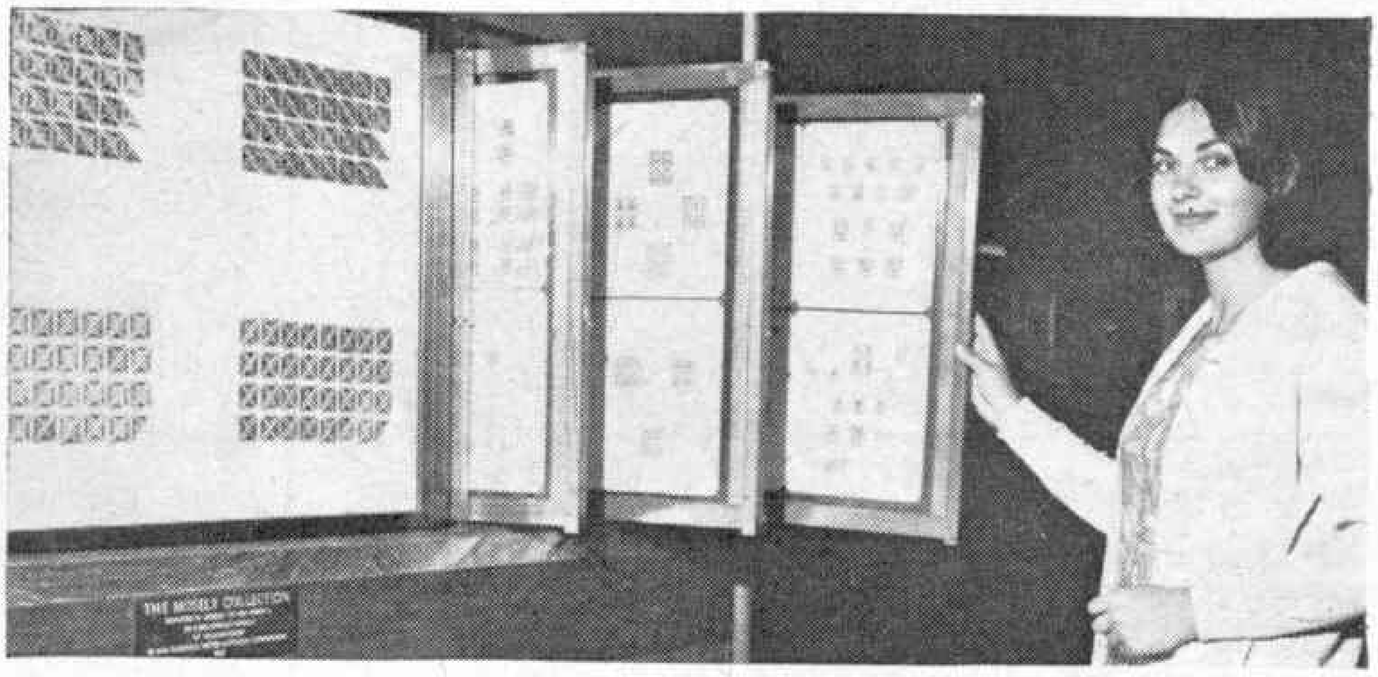


PROBABLY THE largest collection of stamps in the world is that housed in the British Museum in London. Now numbering over four million stamps this vast collection covers the entire world from the earliest stamps—the famous Penny Black and Two-penny Blue of 1840—to the latest issues of the Commonwealth. Indeed, some of the stamps in the collection have not even been issued yet, including a number of sets which will be released in some of the more remote colonies later in the year. These are sent to the British Museum by the Crown Agents, often weeks or months before they are actually put on sale!

Visitors to the Museum, which is situated in Great Russell Street in Bloomsbury, a stone's throw from Tottenham Court Road tube station—may see some of the incomparable rarities of philately any day of the week. The Museum is open to the public from 10 a.m. till 5 p.m. on weekdays, and from 2 p.m. till 6 p.m. on Sundays. At the far end of the great gallery known as the King's Library (so-called on account of the magnificent library of travel and farming books formed by King George III which is contained there) are several large cabinets with sliding frames. These contain a few of the Museum's stamp collections. On the left are three cases containing the famous Tapling Collection.

This collection was begun in 1866 by the ten-year-old Thomas Tapling and was bequeathed to the nation following his death at the early age of 36. Young Thomas was once given £100 by a benevolent relative with the injunction that the money had to be spent and not banked. He promptly spent the lot on stamps—and when one considers the purchasing power of money in the 1860s (the average workman earned less than £1 a week) you can get some idea of what such a sum of money meant in those days. As a schoolboy Tapling was able to buy, for a pound or two at the most, stamps which today change hands in auction for several thousands. Later in life, when he inherited a fortune, he was able to buy almost any stamp on the market and at the time of his death in 1891 his collection was regarded as being the second largest in the world and worth. £50,000. The only collection which surpassed it was that formed by Count Ferrary and that was seized by the French during World War I to pay part of the German war indemnity. The Tapling Collection, which has a current value of £1½ millions, is the last of the great nineteenth century collections in existence. The legendary rarities, such as the Hawaiian "Missionaries",





At top of page: James A. Mackay shows a visitor the Bojanowicz collection of Polish stamps. The submarine "Orzel" made itself famous by escaping the country during the German occupation and appeared on stamps issued by the Government in exile, based in England. Above: Part of a monthly, new issue display of Commonwealth stamps. The case displays the original artwork and finished sheets of stamps. Right: A visitor examines the Mosley collection of African stamps. Note the proof sheets of Cape of Good Hope triangulars, so called "Woodcuts."

the British Guiana "Cottonreels", the Mauritius "Post Office" and the Canada "Twelvepence Black" are all well represented, not to mention countless other scarce stamps from the first fifty years of philately.

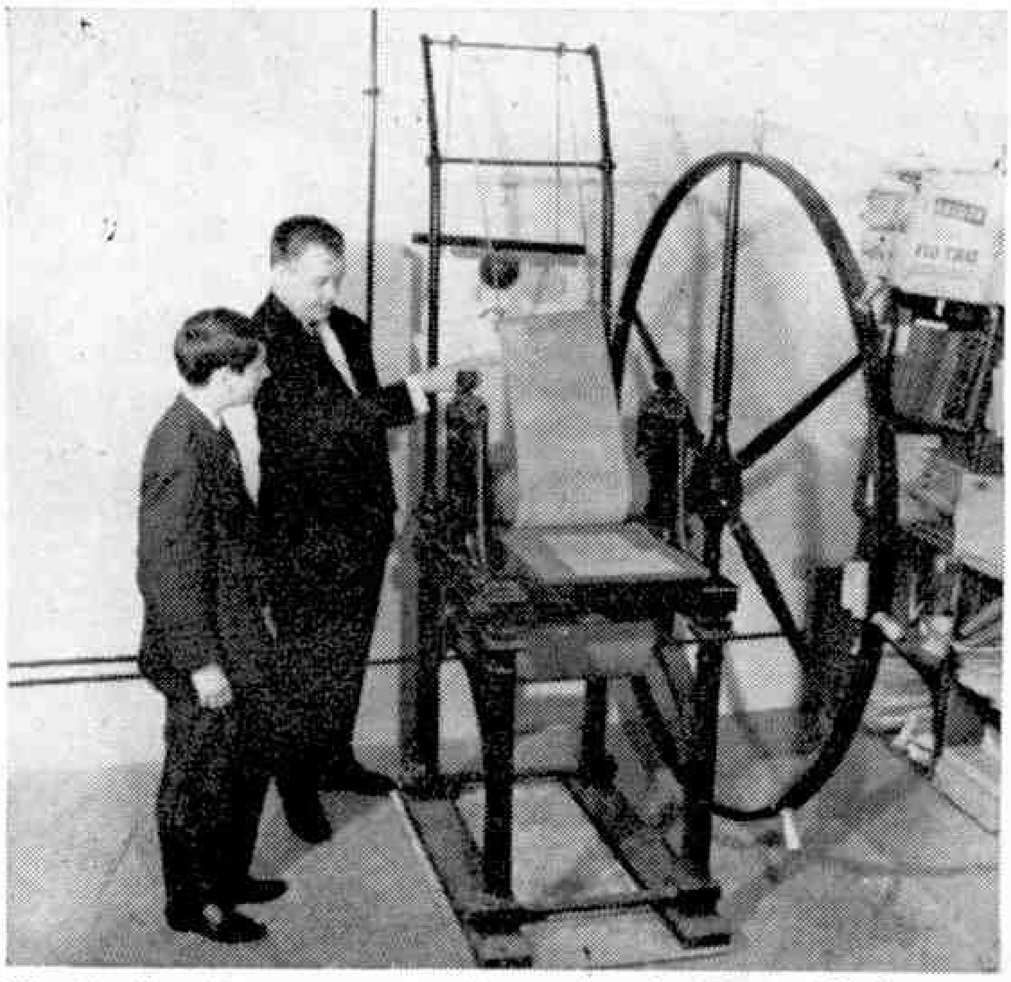
In an adjoining cabinet is a fine collection of stamps from British Africa, assembled by the late Dr. Edward Mosely of South Africa. In some respects this collection overlaps with the Tapling but certain sections, such as Cape of Good Hope and Orange Free State are more highly specialised and, of course, the Mosely Collection contains stamps down to 1935 (the Silver Jubilee series). Apart from the veritable feast of Cape Triangulars there are many rare or unusual pieces, ranging from the early stamps of Mauritius to the intrigueing makeshifts produced by the Boer guerrillas during the war of 1899-1902.

One of the more recent acquisitions of the Museum is a collection which illustrates the wartime history of Poland. In September 1939, when Germany and Soviet Russia invaded and dismembered her, Poland ceased to exist as a separate independent country, but the spirit of her people survived and this is reflected poignantly in the philately and postal history of the period from 1939 till 1945 when Poland re-emerged after the war.

Stamps were produced by the Nazi "Generalgouvernment" but some of these were clandestinely overprinted by the underground movement with a swastika hanging from a gallows. The Polish government in exile in London produced some very attractive stamps and imitations of these were used by the Polish resistance operating their own postal service in occupied territory. Special stamps were issued for use by the Jews in the Lodz Ghetto and there were even stamps produced by the inmates of prisoner of war and concentration camps. Perhaps the most pathetic reminders of the terrible sufferings endured by the Poles are the letters and envelopes which were carried by the Boy Scouts' Post during the Warsaw Rising of 1944. One of these postmarks was made by cutting a potato in half and stencilling the Scout fleur-de-lis on it—one of the crudest postmarks, but also one of the rarest ever produced. This collection was donated by Mr. M. A. Bojanowicz, a prominent collector, to mark the millenium of Poland.

Another of the Museum's collections which is rich in human interest is the Fitzgerald collection. Formed by Mrs. Augustine Fitzgerald it contains souvenirs of the airports of the world, the strength lying in the early, pioneer days. A specialised album contains material relating to the Siege of Paris in 1870 and is replete with covers flown by balloon to and from the beleaguered city. The pigeon posts and the tiny microfilmed messages which were attached to the bird's legs are also well represented. The outstanding volume of this collection is devoted to the first Trans-Atlantic flights made from Newfoundland in 1919. The abortive flight by Harry Hawker is represented by no fewer than eleven of the rare "Hawker" overprints—including a strip of three unused, the only large multiple in existence of this major rarity. The souvenirs of the great Trans-Atlantic competition include a ten shilling note autographed by all the competitors, and the pilot's licence belonging to Sir John Alcock whose Vickers Vimy bomber was the first to cross the ocean.

During 1966 the Museum was fortunate to acquire two major collections in the shape of the archives respectively of the Board of Inland Revenue and of Thomas De La Rue and Co. Ltd. The former were transferred from Somerset House on indefinite loan and include revenue stamps dating as far back as



The Perkins-Bacon press used to print the Penny Black stamps in 1840. This was donated by the manufacturer to the Museum in 1964 and weighs nearly one ton.

1712. Two volumes of proofs in this collection contain the embossed tax stamps produced in 1765 for use in the American Colonies. The protests of the colonists were so vociferous that the Government repealed the Stamp Act the following year. Nevertheless the offending stamps undoubtedly contributed to the grievances which led the colonists to declare their independence and form the United States.

The Board of Inland Revenue was directly responsible for stamp production in Britain from 1840 till 1930 when this task was shouldered by the General Post Office. Thus material from the first ninety years of British stamps—proofs, essays, colour trials and imperforate specimens—are well represented in the archives now in the Museum. A selection of this material is on permanent display in the King's Library.

The other great collection added in 1966, the De La Rue Archives, consists of 82 large albums containing artists' sketches, proofs, colour trials and, of course, examples of the issued stamps. Since 1853 De La Rue have printed stamps for about 180 different countries, so you can imagine the wealth of material which their archives contain.

The Tapling Collection contains a virtually complete collection of the stamps of the world from 1840 till 1890, but after that date the Museum had neither the means nor the staff to keep the collection up-to-date. Consequently, as the years went by, the chances of completing a collection of world stamps became more and more remote. Fortunately the General Post Office came to the rescue a few years ago by handing over to the Museum a vast accumulation of stamps of the whole world. The G.P.O., like other members of the Universal Postal Union, receives three copies of every new stamp issued by other member countries; thus three separate collections could be formed and one of these was transferred to the Museum. This practice only became regularised about the turn of the century so that the Post Office collection is complementary to the Tapling and brings it right up to the present time. About 6,000 new stamps are added to this collection each year and the number of new issues is steadily increasing. A portion of this collection will shortly be

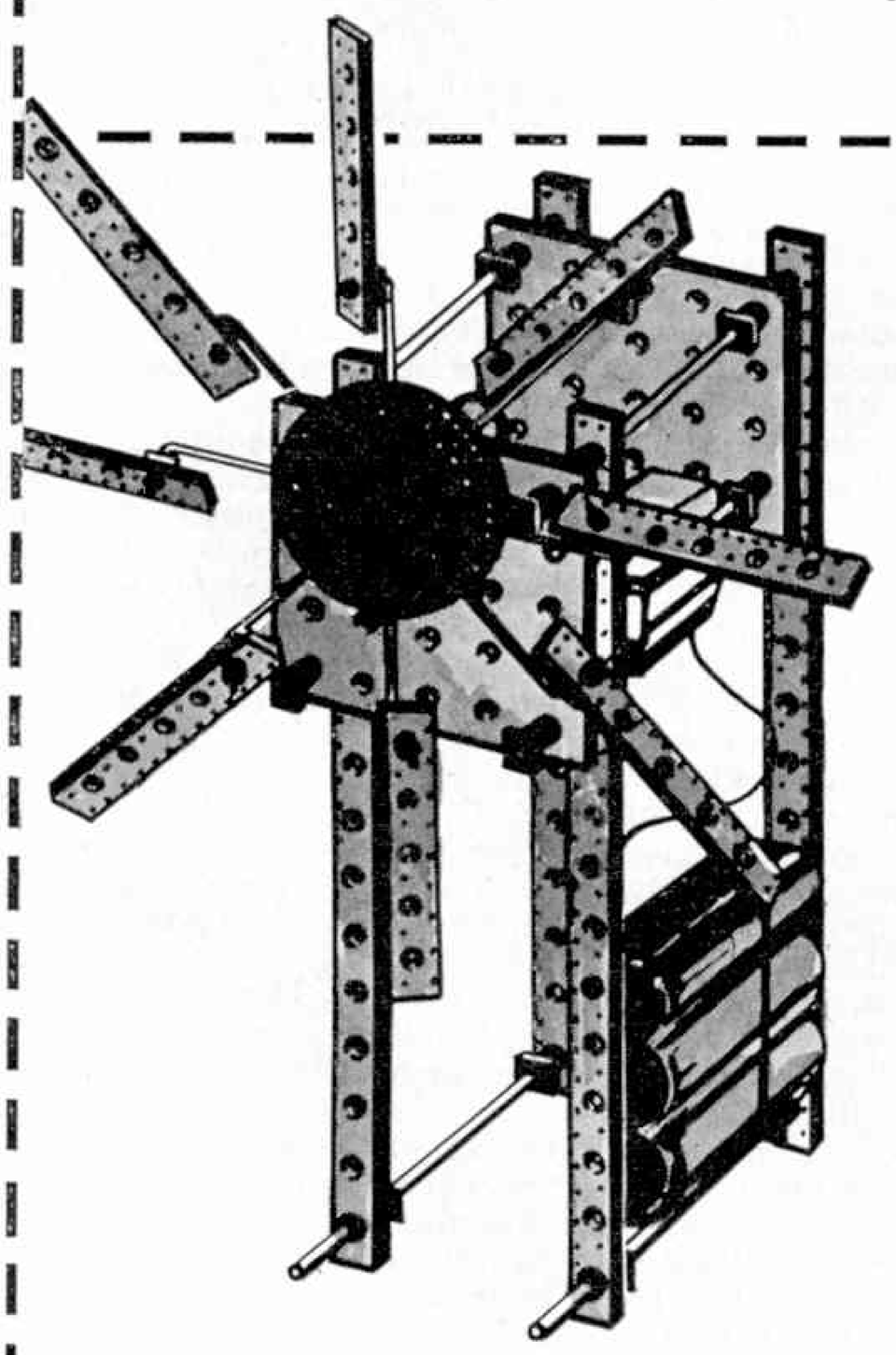
Continued on page 663

CUT THIS LEAVE IT ON

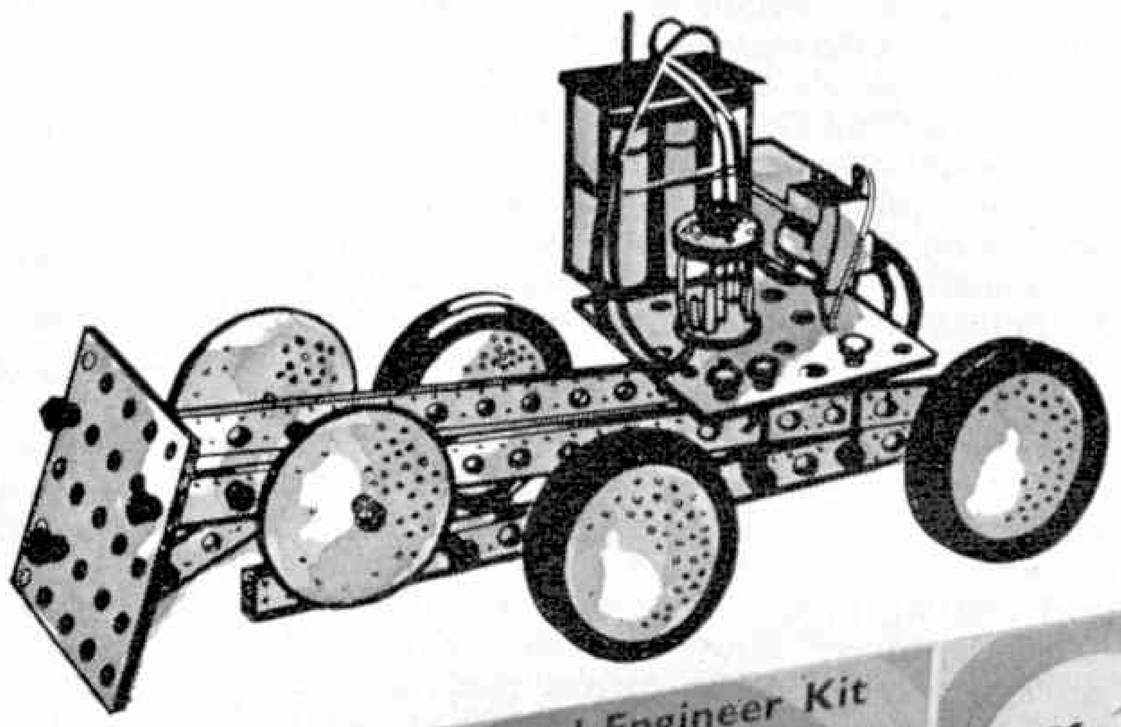
Dear Dad,

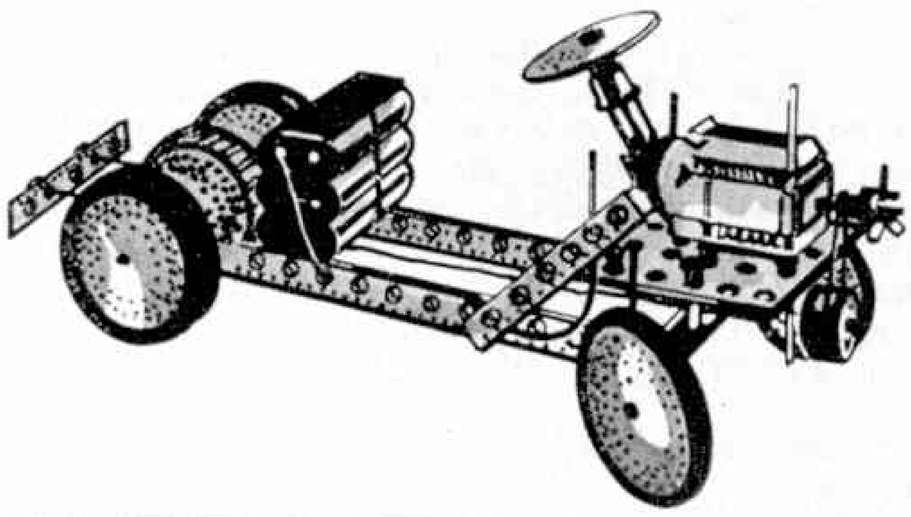
I'd love a Philips Electronic or Mechanical Engineer Kit for Christmas.

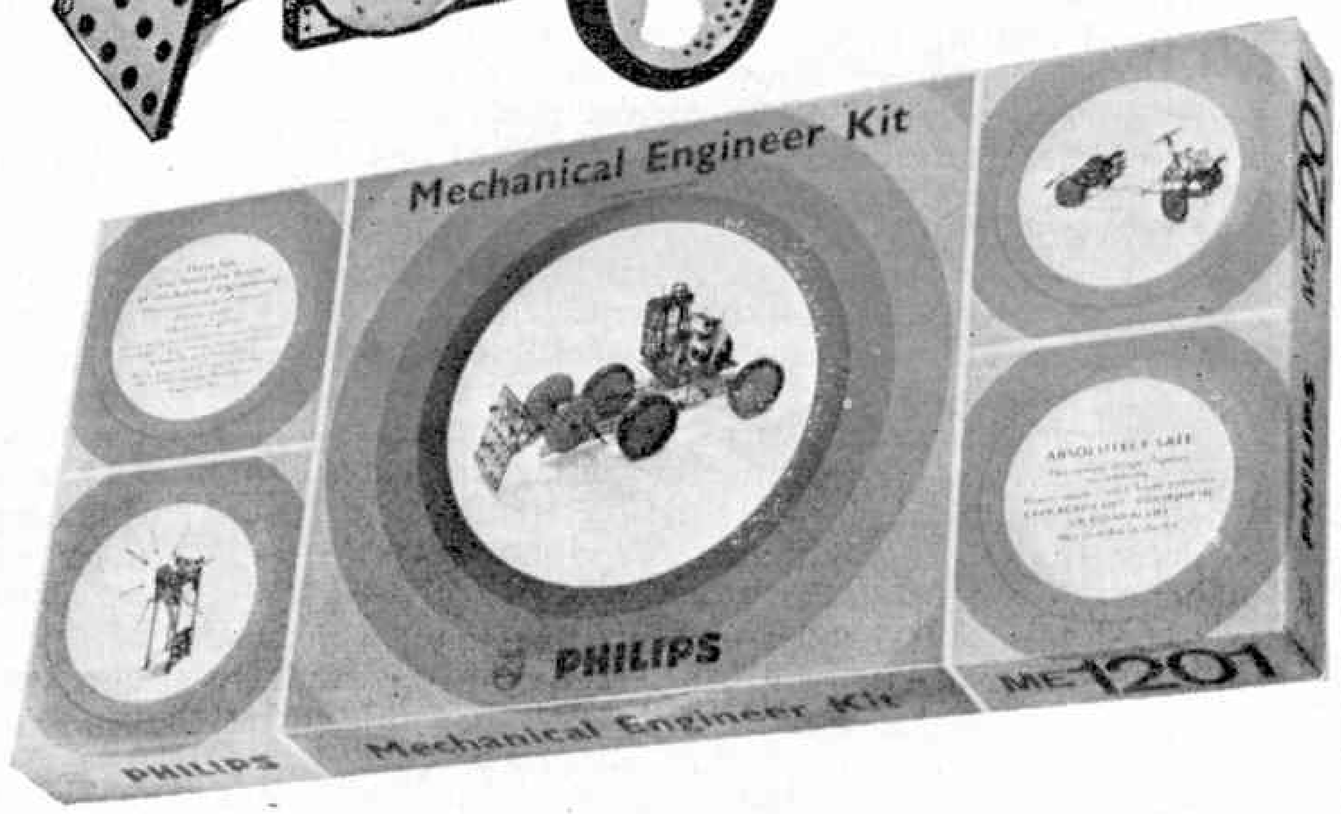
Signed_____



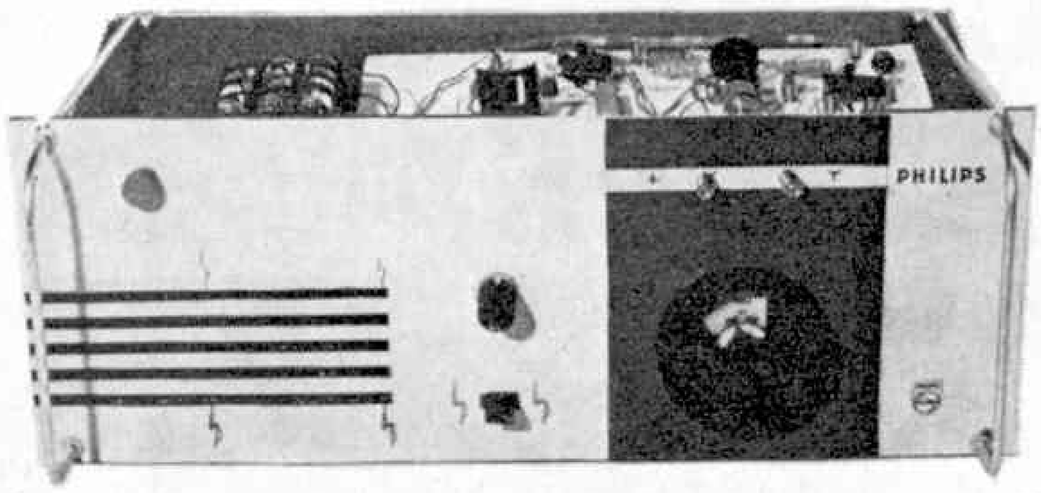
With Philips Mechanical Engineer Kit ME 1201 I can build 25 exciting models – different kinds of cars, cranes, elevators, dynamo, a fan, a bulldozer. Fascinating, gaily coloured working models.



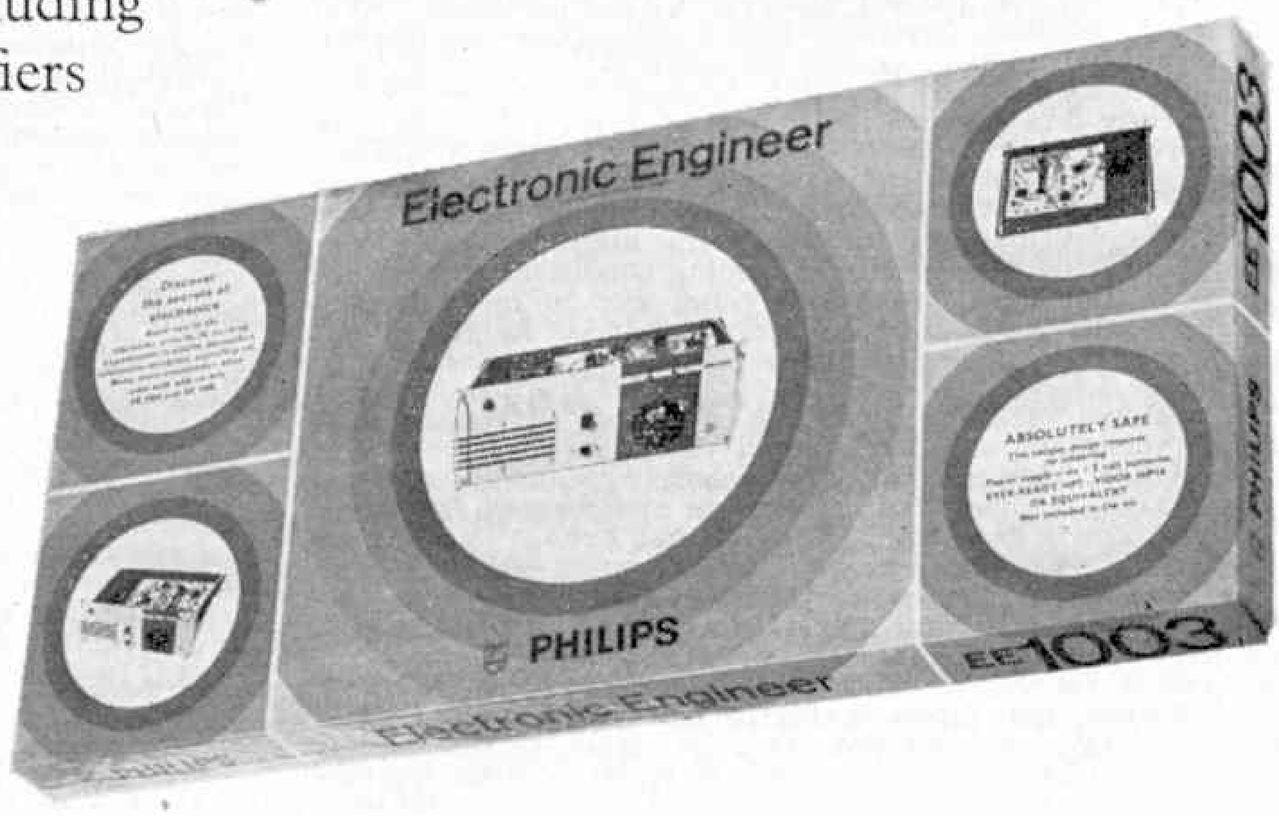




OUT AND DAD'S PILLOW!



The Electronic Engineer Kit EE 1003 builds another 24 models, including radios, burglar alarms, amplifiers and signalling systems. Combine the Electronic and Mechanical Kits and even more fascinating models are possible.



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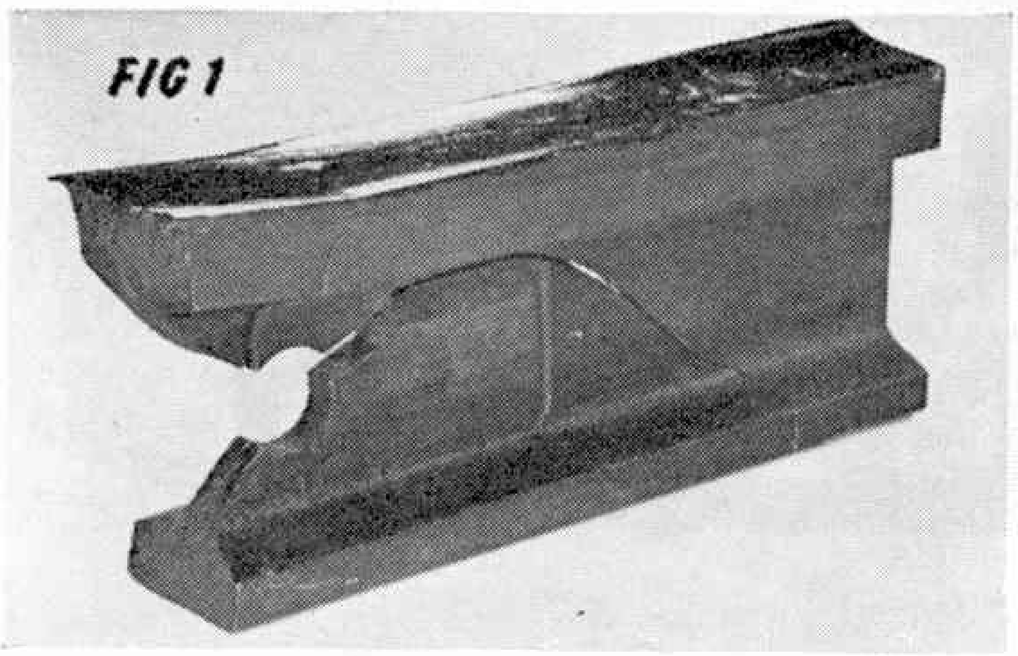


METAL FATIGUE

by D. L. McDiarmid

WE READ in the newspapers of ' metal fatigue ' being the cause of serious accidents or disasters involving aircraft, submarines, cars and engineering machines of many types. The two accidents involving Comet aircraft in 1954 are fairly recent examples of disasters involving advanced engineering design, which were found to be caused by metal fatigue.

What is ' metal fatigue ' ?

It is fracture due to repetition of load as distinct from fracture due to the gradual application of load. The difficulty in designing to allow for metal fatigue is that the repeated load to cause fracture is less than the single gradually applied load to cause fracture. As the majority of engineering machines and structures are subjected to a variety of loading conditions throughout their useful life, they may possibly fail due to metal fatigue and have to be designed with this in mind. In fact about 80 per cent of the failures in engineering components are due to metal fatigue.

This problem of metal fatigue is not new. It is, in fact, **over 100 years** old and first caused extensive trouble around the year 1850, during the development of railway systems, when the axles of many railway engines and wagons fractured.

This problem is not completely overcome yet, as is indicated by the fact that London Transport Underground Railways have had to scrap about 4000 axles in the last 20 years, at a cost of £500,000, due to fatigue cracks being found in them, which would have eventually caused the axles to break.

The recent railway disaster at Hither Green, caused by a fatigued broken rail shows the importance of fatigue failures and the difficulties of inspecting them for cracks, so that repairs can be made before fracture occurs. A typical fatigue fracture in a rail is shown in Fig. 1.

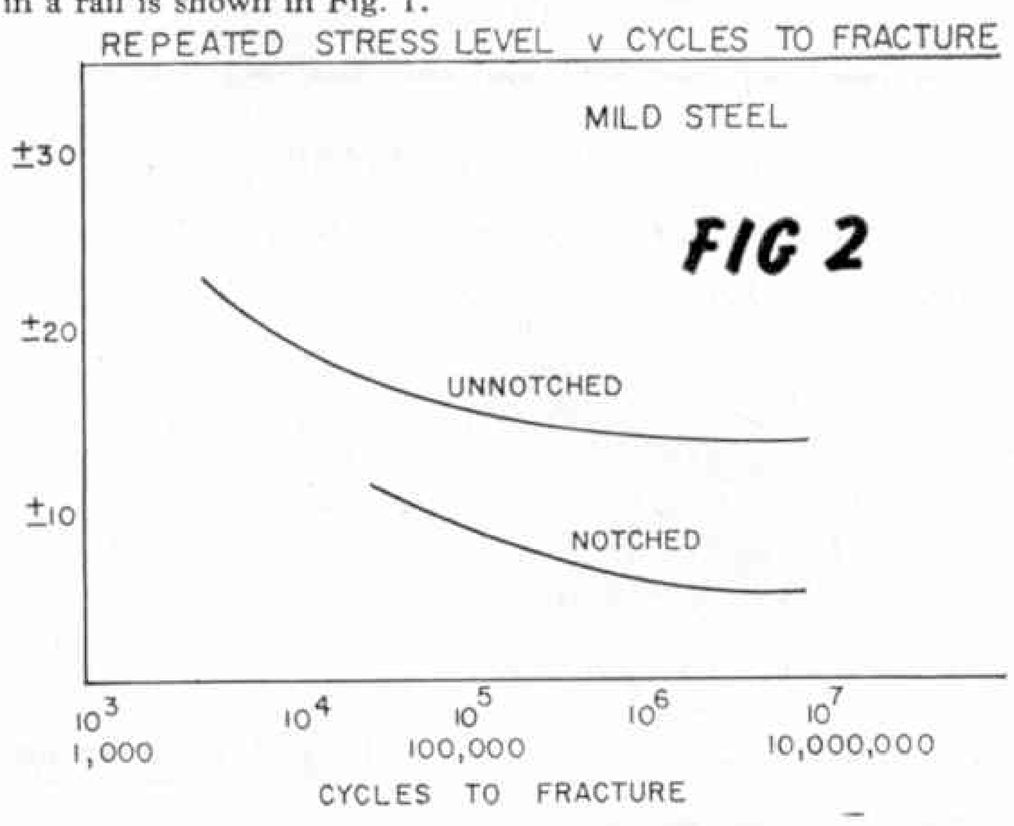


FIG 2

How do we cope with this problem of metal fatigue ?

The engineer studies ' how ' the machines he builds work and investigates the conditions and loads which cause fatigue failures. The question of ' why ' fatigue failures occur is more the realm of the metallurgist or the physicist who study the structure of materials at the atomic level.

The engineer bases his original design work on a very large amount of data which has been accumulated from tests carried out on specially prepared specimens under known conditions of load.

For example it has been found that for mild steel, if the repeated stress (the stress at a point in a material is the load per unit area at that point) is kept below approximately half the value of the gradually applied stress to cause fracture, then fracture by metal fatigue will never occur, regardless of the number of times the stress is repeatedly applied. This stress level is known as the fatigue limit.

A typical stress level v. number of cycles curve for mild steel is shown in Fig. 2. Note that the number of cycles scale is logarithmic. This material has a strength of 30 tonf/in^2 under a gradually applied load but a fatigue limit of 15 tonf/in^2.

One of the most common types of fatigue testing machine is the rotating-bending type. The main components of the machine are shown in Fig. 3 and an actual machine in Fig. 4. One end of the test specimen is held in a chuck and the bending load is applied through a bearing at the other end. An electric motor rotates the specimen which, if the stress is above the fatigue limit, will fracture at section AA where the stress is greatest.

When the load is suspended from the end of the specimen, as shown in Fig. 5, the upper portion of the specimen will be in tension and the lower portion in compression. It can in fact be shown that at any instant the stress distribution varies linearly with vertical distance from the centre of the specimen.

Thus when the motor is switched on and the specimen rotates consider what happens to the point X initially in tension at the top of the specimen. As point X approaches position, X_1 the tensile stress decreases to zero and then becomes compressive on leaving position X_1, increasing to a maximum compressive stress value at position X_2. The reverse procedure returns the point considered to its initial position at X. The variation of stress with time, for any point on the surface is then as shown.

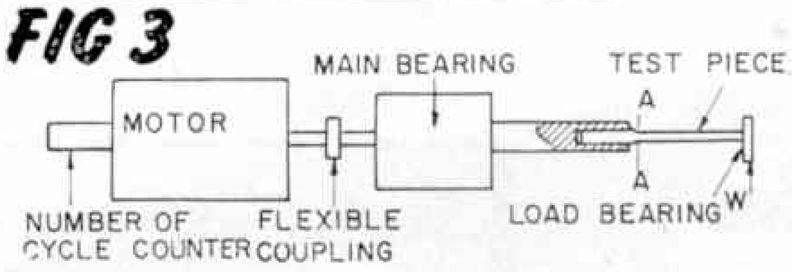
Typical failures using this type of machine are shown in Fig. 6. A crack starts at the surface and progresses inwards till the remaining material can no longer sustain the applied load and fractures. Notched specimens fail at lower stresses than unnotched specimens due to what is known as the stress concentration effect. The stress at the root of the notch is aggravated by the sudden change in section of the specimen. This is why most fatigue failures start at joints, keyways, oil holes, bolt holes and sharp changes in section.

Fig. 2 shows that the notched fatigue strength may be only $\frac{1}{3}$ of the unnotched fatigue strength, thus it is very important to avoid sharp changes in section wherever possible, especially at highly stressed regions.

An ordinary electric hand-drill may be used as a rotating-bending type fatigue machine as shown in Fig. 7. Suitable specimens are about 0.10 inch diameter (6 B.A. bolts or No. 4 screws) which require about 5 pounds load applied at a 1 inch bending arm to cause fracture in about 5000 cycles (i.e. about 2 minutes for a drill running at 2400 R.P.M.). Take care not to damage the drill casing when gripping in the vice.

ROTATING BENDING FATIGUE MACHINE

FIG 3



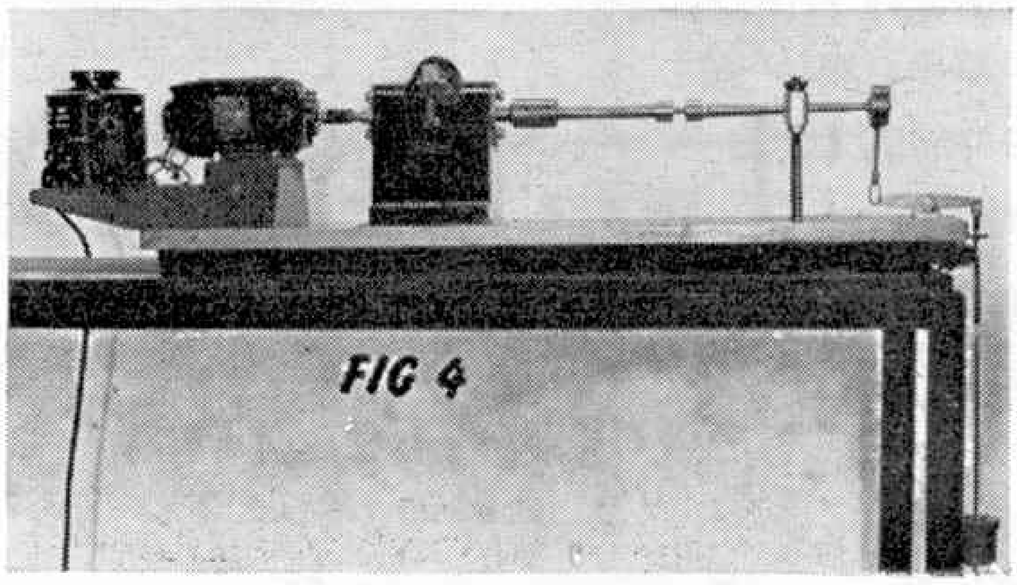


FIG 4

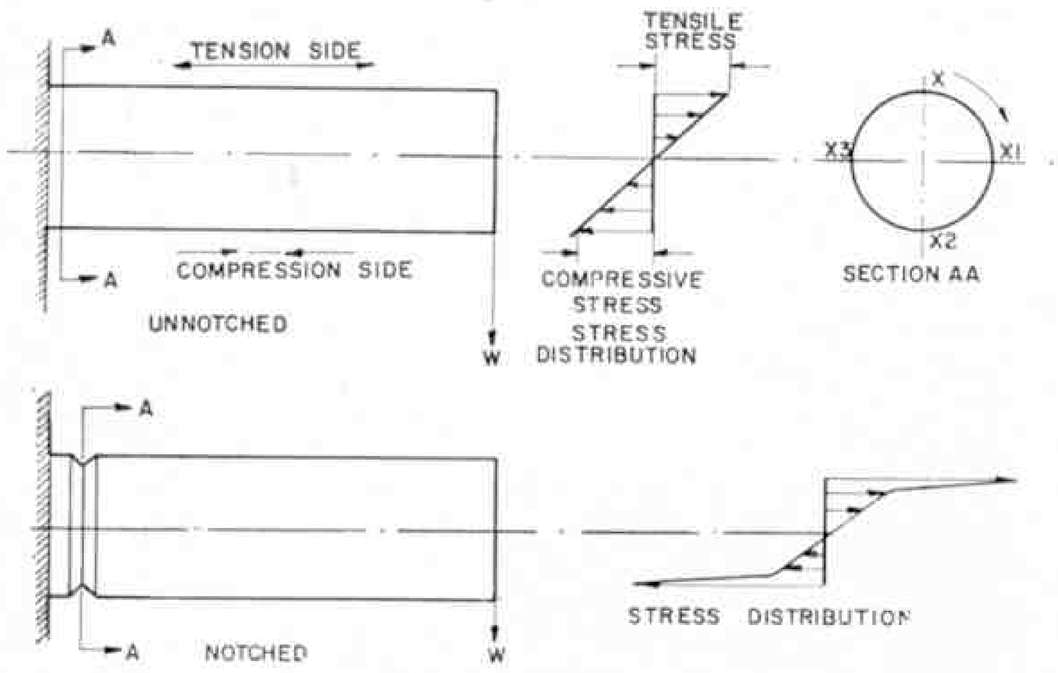


FIG 5

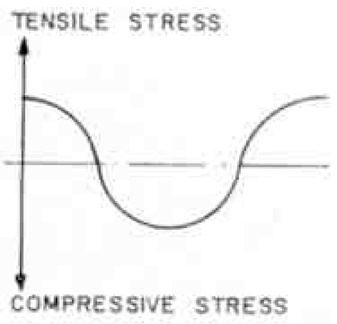
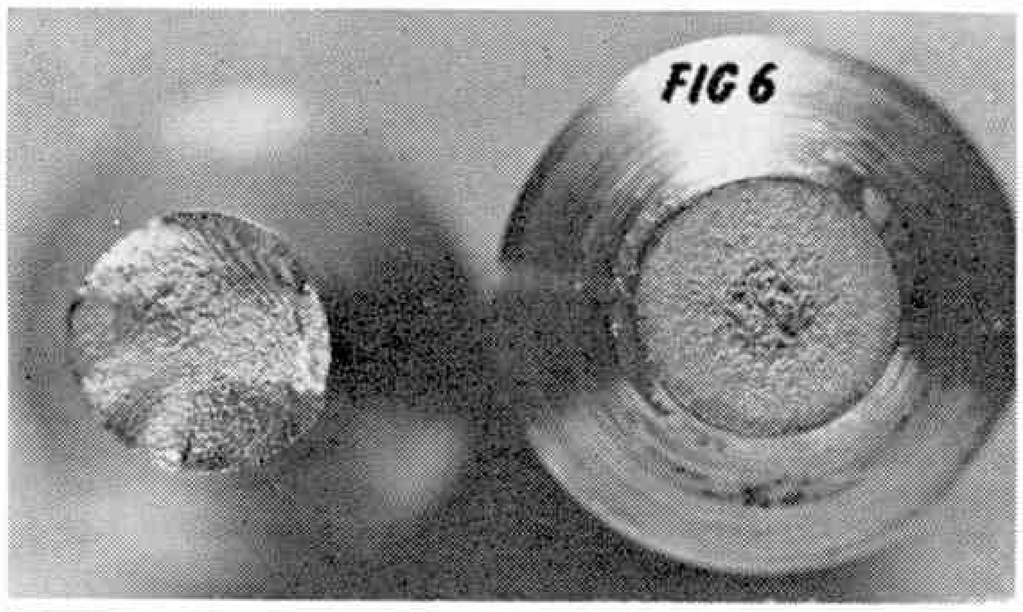
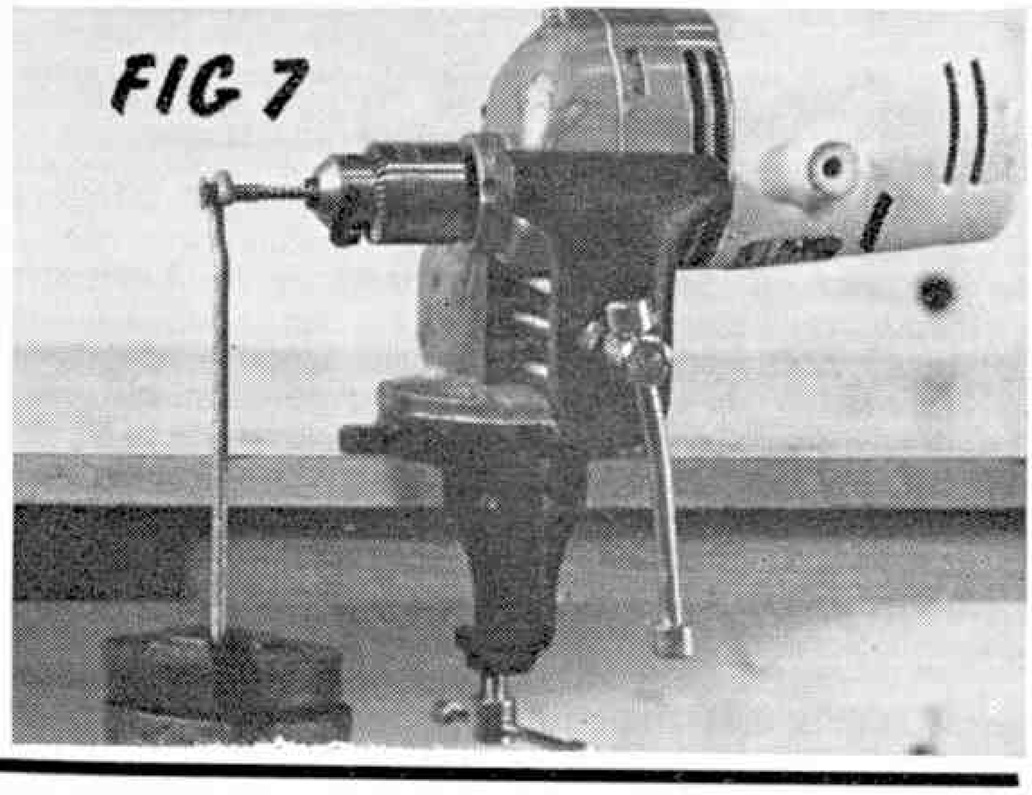


Figure 1: A typical fatigue fracture in a railway rail, the type of thing one reads about in the newspaper. Figure 2: This graph illustrates typical stress levels against the cycles required to fracture. Figure 3: A diagrammatic representation of a rotating vending fatigue machine. Figure 4: The rotating bending fatigue machine with the test specimen just seen as the smallest diameter between the two enlarged bosses. Figure 5: These stress distribution diagrams show that whilst the upper portion of the specimen will be in tension, the lower portion is in compression. Figure 6: Typical fractures due to fatigue under rotation bending. Note one specimen is notched. Figure 7: The use of electric hand drill as a rotating bending fatigue machine.





MONORAILS

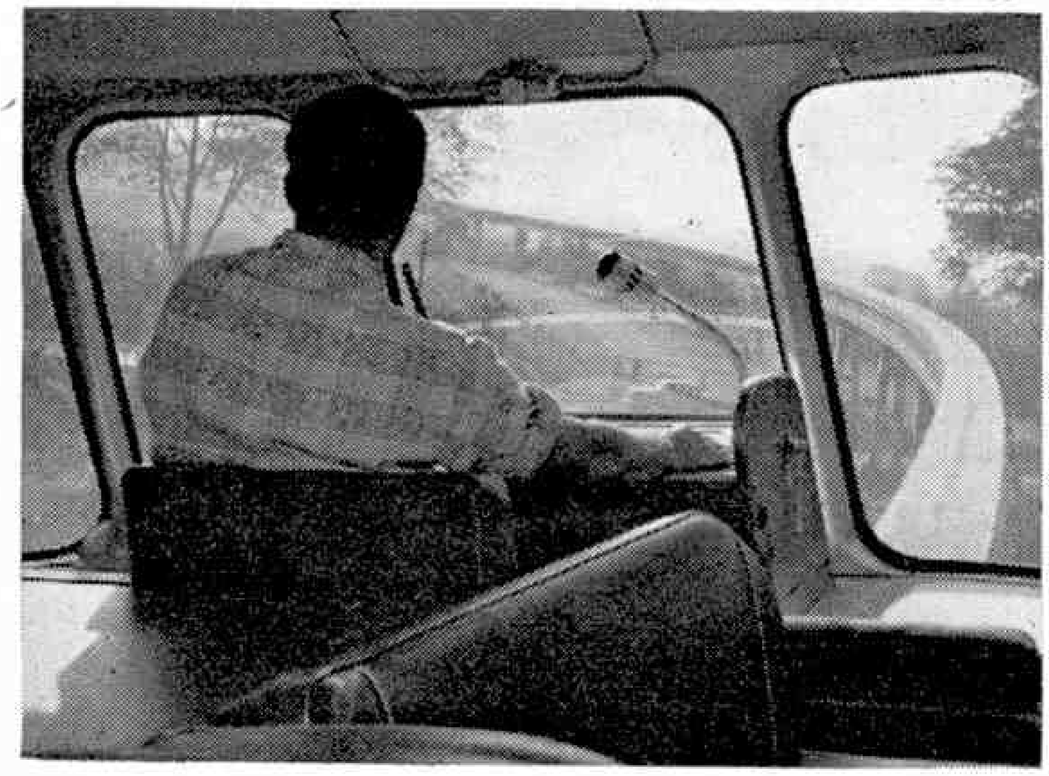
by H. McDougall

Last month's Monorail feature concluded

Several versions of the ALWEG monorail are now in operation. One highly successful installation was erected at Turin, Italy. The track is about three-quarters of a mile long and is operated by a three-car unit with a capacity of 340 passengers. It provides a 50 m.p.h. shuttle service between two stations at the north and south ends of the Turin National Exposition grounds.

One notable ALWEG installation in North America is that erected at the Century '21 exhibition in Seattle, in 1962. This double-track line is a mile long and links the exhibition with the centre of Seattle.

Two four-car units running on eight sets of driving and stabilising wheels are capable of carrying 450 passengers operating between the two stations at speeds of up to 60 m.p.h. Each train consists of four cars, is 123 feet long, 10 feet 3 inches wide and 14 feet high and has a total weight of 100,000 lb.



A typical drivers eye view on one of todays many mono-rail railways. Note the spacious cab and radio communication microphone. This one is in Germany.

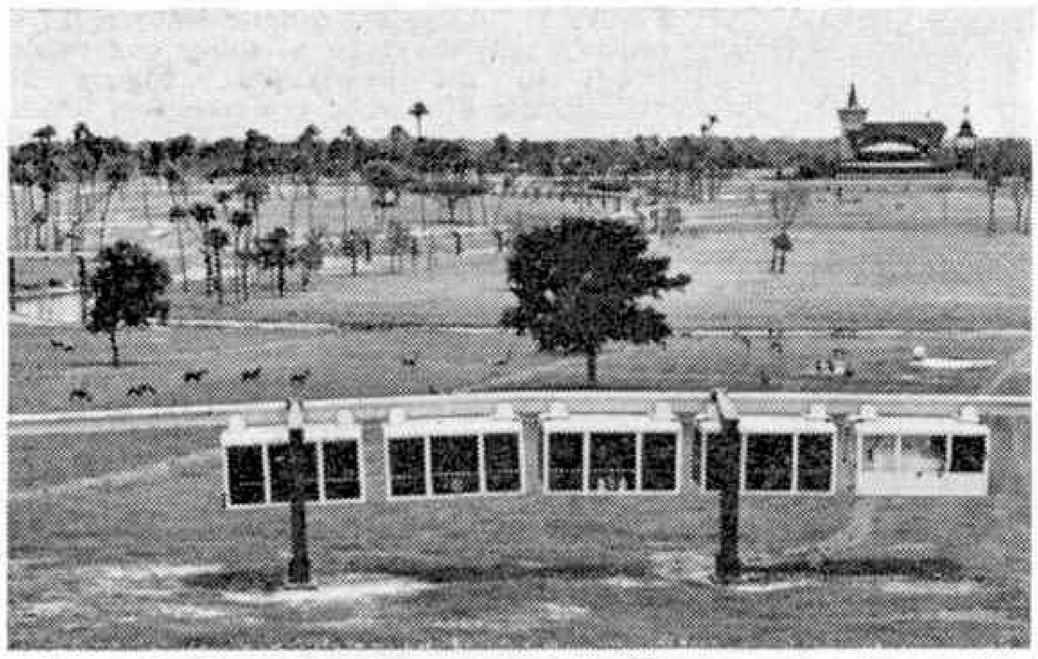
Power is provided by eight 100 h.p. electric motors —one motor for each set of driving wheels—and is transmitted to the wheels from the driving motor by a propeller shaft via a double reduction gear box. Braking is by an air-operated system used in conjunction with dynamic braking; in the case of air pressure failure, the brakes are applied automatically giving a decelleration rate close to the required emergency rate.

Power is 600 volts DC picked up by current collector shoes installed in the monorail cars from contact rails running alongside the beams.

A less ambitious ALWEG installation is that which carries passengers around Disneyland, California. Built in 1959 to a scale of five-eighths that of the original German installation, the track is 2½ miles long.

Three trains are used. Each has four cars, giving a capacity per train of 106 seated people.

A full-scale ALWEG installation utilising two three-car trains with a capacity of 140 persons per train is installed at Yomiuri Recreation Park in the suburbs of Tokyo. The line has an overall length of two kilometers, a maximum gradient of 65 per cent. and a minimum radius of curvature of about 100 meters. This installation is interesting in that it includes two large bridges. It was the second ALWEG system installed



Above the Busct Gardens monorail. These cars make excellent platforms for viewing the animals. At right another view of the Koln/Fuhlingen Alweg Bahn, in Germany.

in Japan, the first being the Rhine Park Monorail Line of the Nagoya Railroad Co.

Because of the size of the beam or rail, switching of monorail cars will always be more difficult than that of conventional mass-transit vehicles. However, the switches developed for beam-type monorails particularly those on the ALWEG monorail which now connects Haneda airport with the centre of Tokyo have proved very successful in operation. This installation —by far the most ambitious monorail system built to date—may well be the prototype of many similar installations in North America and elsewhere.

Five switches are incorporated into the track. Three are flexible and two are polygon switches. All are of steel construction. Switching time is only ten seconds and the train may be driven safely at a speed of 40 kph.

The Tokyo-Haneda monorail, which has 13.2 kilometers of track, was built by Hitachi Ltd. under licence from ALWEG. The beamways are mostly typical ALWEG prefabricated, prestressed, hollow concrete girders supported on reinforced concrete columns cast in situ. For about 1.5 kilometers of the track—where it runs parallel to and crosses the Tokaido Line of the Japan State Railway—columns and beamways fabricated from steel are employed. These are the only places where the higher cost of the steel structures was considered justified.

The Tokyo-Haneda system has proved that monorails are now thoroughly practical. But research will undoubtedly continue and some engineers feel that monorail cars of the future will ride on air cushions.

The Ford Motor Company advanced this idea some years ago when developing its Levapad system. More recently, the Bertin Company in France has pioneered this type of suspension.

The prime problem an air-cushion monorail raises is that of propulsion. The use of gas turbines driving conventional airplane propellers is one solution, but it might cause unacceptable noise problems. Another possible solution is the use of linear electric motors.

Whatever course future development takes, there is little doubt that a need for mass-transportation systems exists and that it is becoming more acute every year. The problems are now more economic than technical.

Below: These spacious cars are used in the Miama Seaquariam in Miami, Florida, for a terrific aerial view. At right the Tokio suspended system as used in Japan.

BATTLE

Part VIII—Strike values of Anti-Tank Guns

by Charles Grant

IN PREVIOUS numbers we established what we hoped was an effective schedule of the Defence Values of all our armoured fighting vehicles (with the regrettable exception of the Sherman tank, which was somehow overlooked—my fault, entirely—but which can be added to the table with a value of 14) and made a start with a discussion of the power and range of a variety of guns. Having also considered how the use of dice provides the uncertainty factor in "Battle", we must now make an evaluation of the effectiveness of the guns, and we shall then be well on the way towards getting some workable rules for the conduct of an armoured battle.

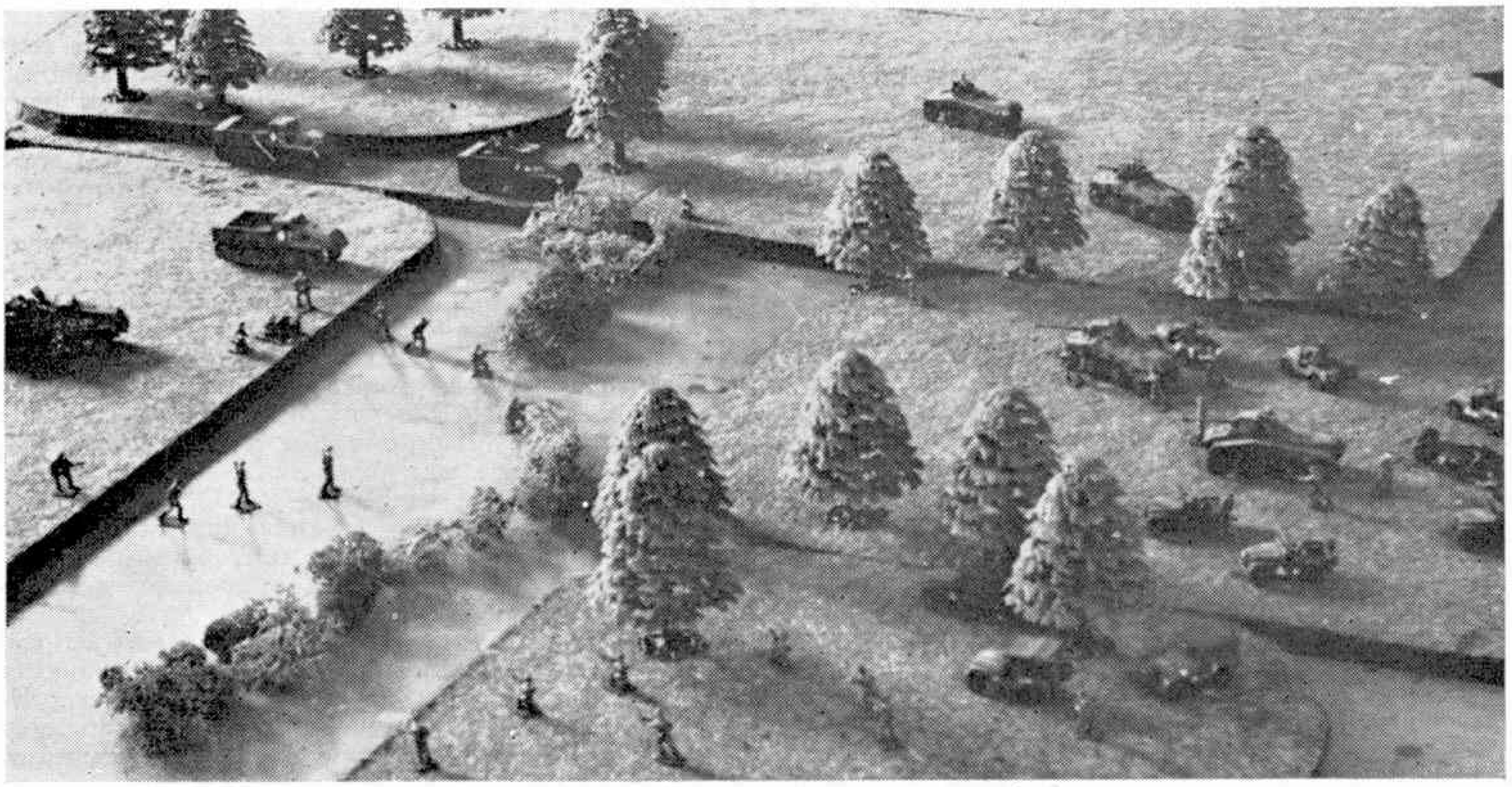
Now this is the sort of thing in which it is all too easy to become quite hopelessly embroiled. In drawing up these rules, which I again stress are 'basic' ones, as well as doing a heap of research on my own account I've been fortunate enough to have had access to the existing rules of certain battlegamers of great experience, particularly in this modern type. Such comparisons of other rules with one's own are very rewarding, but I found that some were quite frightening in their complexity, involving carefully drawn graphs, complicated calculations and goodness knows what else. This sort of thing is not going to be inflicted on the reader—this I can say right away. All I shall do is to demonstrate—as simply as possible—how the two values, those of Defence and Strike, work in conjunction with a variable, the dice effect, and then to give the appropriate Strike Values for the guns discussed in Part V, when we worked out various ranges for them.

Let us take as an example the German 75 mm (long) A.T. gun to which we gave a maximum effective range of 1500 yards—or 45 in. on the battlegame table. (In future we shall if possible refer always to the table range in inches rather than to that of the 'real thing' in yards). Having consulted various data charts on penetrative power of this particular weapon we find that at this range an armour piercing shell fired from it would penetrate about 75 mm. of armour thickness. I emphasise the word 'penetrate' because the penetration, while causing a considerable amount of discomfort, would not necessarily destroy the vehicle protected by this armour. In fact, at maximum range, the chances are that it would do precious little damage at all.

Having a look at the Table of Defence Values we see right away that the Sherman (we shall take it as an example to compensate for its not being included in the Defence Value Table in Part VI) has a Defence Value of 14—it has a maximum armour thickness of 76 mm. So, we have to give the 'long' 75 mm. gun an attack value which will give it—together with a dice throw representing the 'imponderable'—as nearly as possible the same chance of destroying the Sherman as it would have had in actual operations.

To use a single dice for this throw would reduce the range of possibilities most unrealistically, so we employ two, no less. We have then to gear the Strike Value to the fact that the maximum that can be thrown with two dice is 12. Suppose then we say, that at 45 in. range—maximum effective—the 75 mm. has a Strike Value of 4. This means that, to destroy the Sherman, the player whose gun is firing has to throw with two dice a total which, together with the given Strike Value, will exceed the Defence Value. With two dice, then, he must throw 11 to 12 to destroy the tank. We don't have to go into the realms of calculus to see that with two dice he has two chances of throwing what he needs—the 11 or 12—out of the 21 possible variations which can come up. So, roughly speaking, the chances of knocking out the Sherman at maximum range with one shot would be about one in ten, and this, in practice, seems to be about right (not forgetting

"Battle" is joined—a bird's eye view of a skirmish in progress —infantry and light vehicles being involved.



that at long range—as we shall see—it is by no means easy even to score a hit).

Needless to say, at closer ranges the Strike Value must naturally be increased and we have to establish some sort of rule of thumb on when to say that point-blank range becomes medium range and so on, without making the thing too complicated. If we take 45 in. as maximum effective range, we can divide this into four sections, thus—0 in. to 10 in., 10 in. to 20 in., 20 in. to 30 in. and 30 in. to 45 in. Continuing to take the 'long' 75 mm. as an example, at 0 in. to 10 in. its Strike Value will be 7, at 10 in. to 20 in. it will be 6, and at 20 in. to 30 in. it will be 3. At long range, as already seen, it is 4. On the face of it, at first sight there does not seem to be a great deal of difference between the various Strike Values, but nevertheless it will be found to be quite substantial. For example when one has to score 7 or more with two dice, there are no less than 12 possible combinations by which this may be obtained out of the total of 21. The possibility then of destroying our sample Sherman leaps up from one in ten at long range to over one in two at close range.

A tremendous amount of facts and figures exist to cover the effectiveness of every possible gun in every circumstance you can think of, but space does not permit even a resume of this, although all of it is very important as a background to why a certain gun has a particular strike value while a second has a slightly lower value, and so on. Such technical stuff can be pretty boring reading as well, so let it suffice to say that the Table of Strike Values is in fact the product of research plus lengthy trials in "Battle" where they —the Strike Values—seem to work satisfactorily.

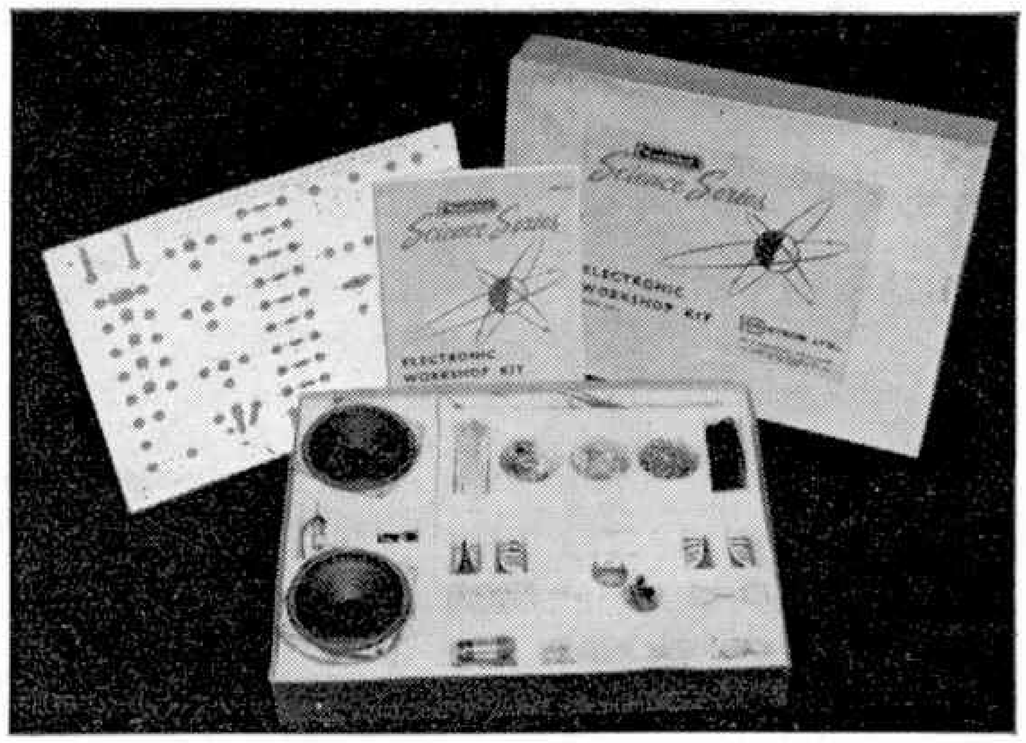
TABLE OF STRIKE VALUES

Weapon	Nationality	Ranges in inches			
		0 to 10	10 to 20	20 to 30	30 to 45
88 mm	Ger.	12	11	9	7
17 pdr.	Br.	12	10	8	6
85 mm	Russ.	11	9	8	6
76 mm	Russ.	8	7	5	4
76 mm	U.S.	7	6	5	4
75 mm (long)	Ger.	7	6	5	4
6 pdr.	Br.	5	4	3	—
75 mm (short)	Ger.	4	2	1	—
57 mm	Russ.	6	5	4	—
50 mm	Ger.	5	4	3	—

(NOTE—What we might call the "ambush" weapons —Bazooka and panzerfaust—will be dealt with later under the general heading of infantry weapons).

A few points should be noted concerning the Table, the first being that not every battlegamer will necessarily agree with the relative scale of values given, but it has been tested most thoroughly and does give a good idea of armoured warfare. It may be thought that I have been over generous to the defence, but I would point out that it was a comparatively rare thing in the time of which we speak to destroy a tank with a single first shot. Such things are fine in the cinema, but it was indeed a lucky gunner who, when first glimpsing

Continued on page 672



SIMPLE ELECTRONICS

Meccano Magazine staff member G. Blackwell reviews a Heathkit Science Series Kit

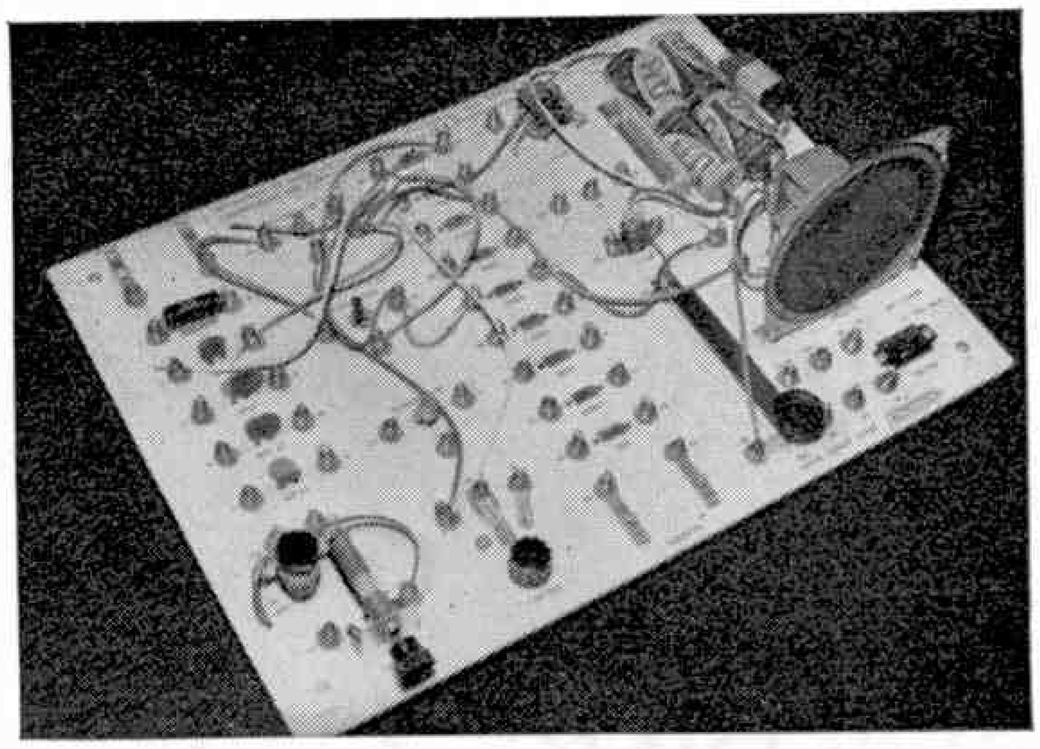
KNOWING THAT the majority of *Meccano Magazine* readers like things of a technical nature, and Christmas is in everyones mind, we decided to construct one of HEATHKIT'S educational Science Series kits. This particular one, the Electronic Workshop Kit EW-1, costs £6. 16. 0., and is advertised on page 629 of this magazine. The kit was designed not only to give the constructor many hours of enjoyment but also to give a foresight into the workings and principles of electrical circuits and components.

Today with the great number of electrical engineering opportunities for youngsters, one can never start to learn or supplement ones schooling in this subject too soon. This simple kit can teach you in a few hours what may take months in a classroom, and it is a well known fact, that by learning through practical work and not only theory, principles are remembered far more easily.

The kit contains over four hundred parts, these include a hardboard base board, with pre-drilled holes and all the terminal positions printed on it. This single board forms the basis of every experiment. Also included are transistors, capacitors, resistors, tuning coils, two 4 in. speakers, on/off switch and an earphone. Some 46 different pre-cut lengths of wire are included so you do not have to cut any yourself, just select the one you need. There are also 5 sizes of nuts, screws and washers, 4 Ray.O.Vac ILP batteries, battery mounting brackets and contacts, 72 terminal connector springs, a fully illustrated construction manual, and other components such as control nobs, etc.

The 72 page, 10 inch × 7½ inch size, constructional manual make electronics seems very easy, even a 12 year old can construct the most complicated experiment detailed in this manual. As well as giving step by step assembly instructions for the experiments, it

At right: The Workshop kit wired up for the audible Morse Code experiment. This is one of the simplest experiments.



is also a very good reference text book. It explains in both words and pictures, what the function of each component is and how the experiment works in theory. This manual contains 21 experiments, beginning with a simple *Code Practice Flasher* and concluding with an involved but basic *Voice Operated Relay* that changes your voice into electrical signals and makes a lamp bulb illuminate.

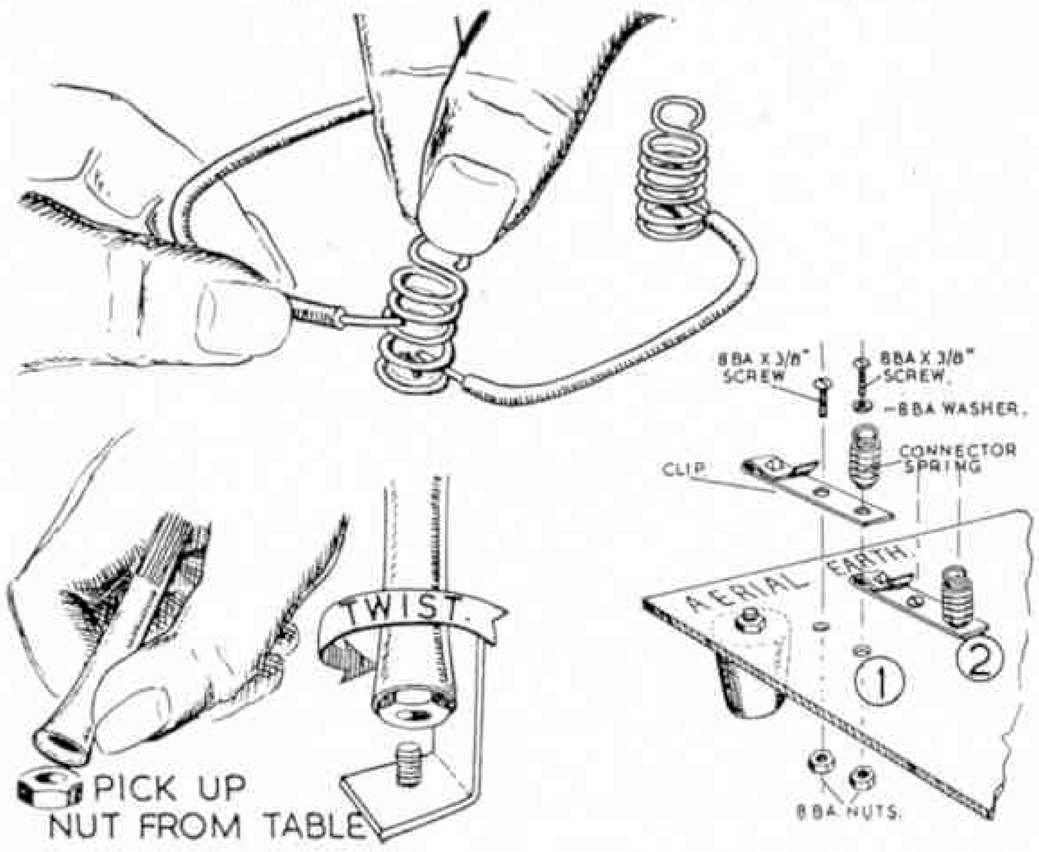
The method of construction is very simple. Before doing an experiment, you must first assemble the basic circuit layout, step by step instructions for this are in the manual. The base board is most cleverly designed with pre-numbered holes, onto which small springs are bolted. The leads of all the transistors, capacitors, etc., are wrapped round the bolts and retained by nuts. All this wiring is under the base board so as not to overcrowd the top when experiments are made. Throughout the construction of the base board and experiments, there is no soldering what so ever, which is very often the main problem for most youngsters when constructing anything electrical. All of the wiring needed for each experiment is held in position by pulling open the terminal connector springs, inserting the wire in between the coils and then releasing the spring to allow it to close up and clamp the wire in place.

Making some experiments

Most of us would immediately open the box and start building, but this is the very thing **you must not do.** You must first remove all the parts from the box and check them off against the *Parts List* in the manual. The author did this and was then ready to begin assembling the basic circuit. This is the most involved part of the kit, for, if a transistor or any other component is put in the wrong hole or wired up the wrong way, the experiment will not work and damage to the components may result. Do not be put off by this though, because the instructions are so clear and understandable, one cannot make a mistake if they are followed exactly.

Before we go any further, it must be pointed out that the author had no previous electrical knowledge or experience at all. Because of this, the first experiment carried out was the simplest in the manual, this being No. 1, the *Code Practice Flasher.* This involved connecting four wires to eight spring terminal connections, so completing a simple electrical circuit with a make and break. The first wire is connected to the contact of the morse key and to the live connection of the light bulb. The second is connected to the earth of the light bulb and to the negative end of the battery. The third connects the positive and negative of the two banks of batteries, and the fourth connects the positive battery to the key arm. With the key arm raised the circuit is broken and will remain so until the key is pressed down onto the key. This allows an electric current to flow out of the batteries, through the lamp, through the key and back to the other side of the batteries so making the bulb light. When the key arm is released, the circuit is once more broken and the light goes out.

The spring method of holding the wires, and the spring retention are clearly shown in this diagram from the handbook. Note the simple plastic socket spanner for tightening the nuts.



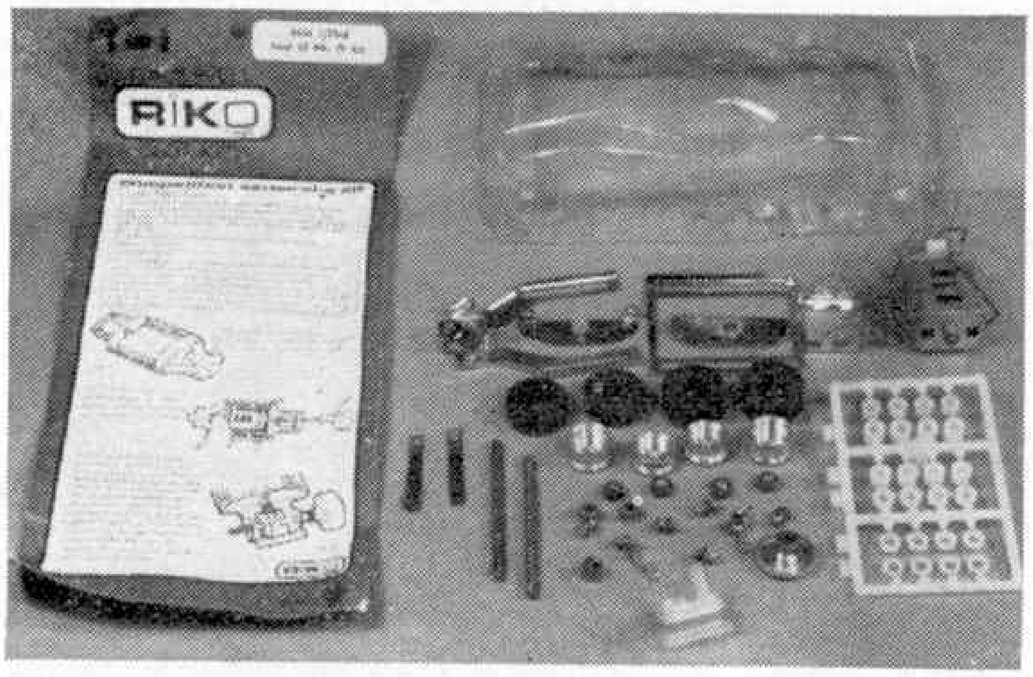
The second experiment was a little more involved; this was an *Audible Morse Code Set.* This experiment required 32 wire connections; the use of 3 resistors, 2 transistors, 1 capacitor, the key and the 4 batteries. This experiment is very similar to a previous one in the manual—the *Metronome.* The ticking noise, which is apparent with the Metronome, is speeded up in the Morse Code Set by the use of a smaller capacitor. The ticking noise is then so fast that it can only be heard as a high pitched "whine", which is similar to that used for Morse Code. The key is this time used to chop the signal into long (dashes) or short (dots) parts.

The Morse Code alphabet is shown at the back of the instruction manual, so with this set, you can learn and practice the morse code which will be very useful if you are a member of the Scouts or a Cadet force.

The third experiment carried out was a *Public Address System.* The 64 wire connections incorporated the use of all 3 transistors, 3 capacitors, 7 resistors, the 4 batteries, one of the speakers and the earphone. Here one uses the earphone as a microphone and speaks into it, while as a substitute for this, the other speaker can be used for the same effect.

As can be seen from these attempts, the same principle of construction applies to all experiments, i.e. the connecting of wires by means of springs to make a circuit. This is very simple for the least skilled person to use, yet so effective.

With Christmas only a matter of weeks away and so many young scientists and electricians wishing to display their talents, this kit, which we recommend as being really good value for money in this age of "gimmick" presents, is an ideal gift.



BUILDING A RIKO SLOT RACING CAR

by Dave Rothwell

DURING THE last few months, the cost of model car racing, particularly on a competitive basis, has risen considerably. Believe it or not you can now spend £30 and more just for one car! Obviously this is out of the reach of most of us, in fact I certainly wouldn't spend anywhere near that amount even if I had it! How then, is it possible, for an outlay of a less than two pounds, to construct a car that will show a clean pair of heels to the majority of ready-to-run types?

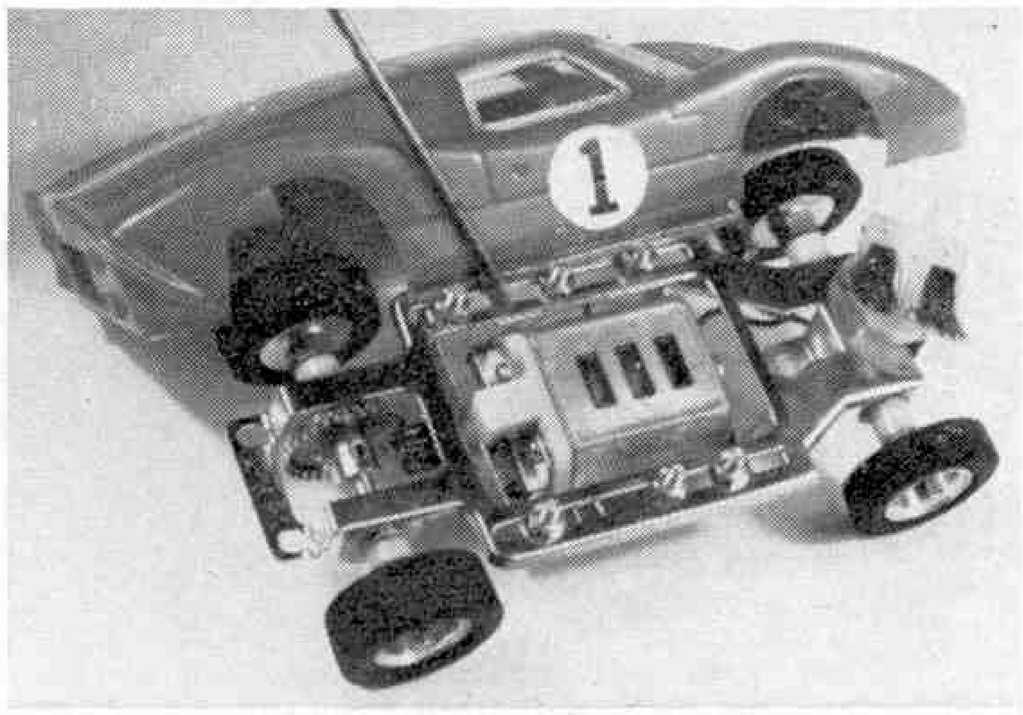
The models I have in mind are the '**Riko**' range of 1/32nd slot racers costing 21/-. These are available from most model shops, and are simplicity itself to construct. In fact once you have managed to build one, you should be able to build any of the others without difficulty. The one I chose to build is the Ferrari 330 P4, but as the rest of the range (apart from the body shells) are identical you can buy whichever one you choose and still be able to construct it, following the procedure I am about to describe.

Now as to actual construction, starting with the chassis unit, which is a simple two piece type. With two brackets for mounting the motor, firstly slide the front part of the chassis (identified by the slot guide mounting holes) onto the top of the rear chassis piece. Using two of the nuts and bolts provided, fit one of these into the long slots, on either side of the chassis to hold them together. Don't tighten them up at this stage with anything other than your fingers. Fit the front mounting bracket to the chassis (the one with a large hole in the centre) using two more bolts and nuts. The holes in both the front and rear mounting brackets were rather small on my model. I filed them a bit longer with a small half-round 'needle file' (obtainable from your model shop for about 2s. 6d.) Repeat the above operation for the rear motor mount (the one with a long slot). Once again leave all the screws loose for the moment. Fit the motor into the chassis by sliding the pinion up into the slot of the rear mounting bracket, then fit the peg at the back end of the motor into the hole in the front mounting bracket. Slide the brackets in towards the motor to hold it in place, and tighten the bolts just enough to hold it in position. Pick up one of the axles and fit one of the 1.0 milimetre nylon spacers onto it. (These are provided in the kit on a white plastic frame. There are six sizes from 1 millimetre to 6.0 millimetres.) Screw one of the four wheel locknuts onto the axle, and then screw on a wheel. With the spanner, tighten the locknut up against the wheel, slide the axle through the holes in the front of the chassis, slip on another 1 millimetre spacer, then another locknut, and finally the other front wheel. Screw the locknut onto the axle with your fingers as far as it will go, screw on the wheel up to the locknut, then tighten the locknut. Check that the wheels spin freely. If not, slacken off one wheel and locknut until they do: do not be afraid to juggle about a lot here—free running front wheels are much more important than a lot of people believe. I've seen cars juddering around tracks doing little bounces on their front wheels because they are so tight, with their owners trying every cure under the sun except the very simple answer of slackening them off! The fittings of the rear axle is a bit more involved, although it's still pretty easy. At this point you should check which way the motor runs fastest. Touch the motor leads to the track and give it a short burst of power, listening to the motor note. Reverse the wires and try again. You will have to install the crown gear on the axle so that when the motor runs in its fastest direction, the car travels forwards.

Slide a 5 millimetre spacer onto the axles and fit on a locknut, then pick out of the packet one of the phosphor bronze rear axle bushes and press it into one of the axle holes in the chassis. You will notice that this bush has a small lug on it which locates in a slot in the chassis. Slide the axle through one of these bushes, then slide the large gearwheel onto it before pushing the axle right through the hole in the opposite side of the chassis. Slide on a 5 millimetre spacer, screw on the locknut and fit the other rear wheel, using the same method as described for the front wheels. Slide the gear into mesh with the pinion on the motor, taking care not to make the mesh too tight. Then tighten up the grub screw with a screwdriver to hold it in place. Now fit the four tyres onto the wheels, narrow ones for the front, wide for the rear. Spin the wheels to check that the tyres are correctly bedded down into the wheel rims.

Next job is to assemble the slot guide and pick-up braids. The braids are in one piece, so fold in half and cut with a pair of scissors. Feed the plain end of each braid down through the slot in the nylon slot guide, leaving about $\frac{1}{4}$ in. at the top end (the end with the hole in). Bend the end forward so as the hole in it lines up with the hole in the nylon guide. Secure it with the tiny chromed self-tapping screws provided. Now slide the guide arm pivot up through the hole at the extreme front end of the chassis, slip the retaining brass collar onto it, then push it up through the top hole. Tighten the retaining screw. To keep the wires from the motor neatly out of the way, coil them around a pencil as shown in the photograph. Then slacken off the screws holding in the braid and wrap one of the motor leads around it, finally re-tightening the screw. Repeat for the other lead wire. Your chassis is now ready for testing.

Holding the rear wheels clear of the ground, and ensuring that the slot guide and brushes are located in the slot on your track, run the motor slowly up to peak revs., keeping your eyes on the rear wheels. If when the motor is running at speed the rear axle moves from side to side this is a clear indication that the amount of play is too much, and needs adjusting slightly. When the motor is running at top speed



The painted block shell and ready to run chassis. Note the adjusting screws for lengthening or shortening the chassis.

release the controller and see how quickly it stops, if this is very rapid the gears, or wheels are too tight, slacken off as necessary. Incidentally, should, when you first press the controller, nothing happens in the way of movement, remove the car and check the gear and wheels for over tightness. If the model still fails to run, check the brushes for contact with the track, or failing to find a fault there, check the motor leads to ensure they are making good contact with the brushes.

Once the chassis is running well, a light spot of oil on the moving parts will help ensure maximum performance.

You are now ready to turn your attention to the body shell. Remove the plastic lip that forms the base of the shell and cut out the wheel arches. (Don't, however, at this stage remove any of the plastic along the base of the doors. We shall be using this as a means of securing the chassis to the body shell). I use a small pair of nail scissors for this as they usually have curved blades, very useful for removing plastic from the wheel arches. When the cutting out has been completed, rub the shell on a sheet of sandpaper to smooth off the lower edges. A small bit of sandpaper wrapped around your finger is ideal for smoothing out the wheel arches. I wouldn't advise trying to cut out the radiator front, or any air vents your particular shell might have, as this can considerably reduce the overall strength of the body and you may find if you have a particularly nasty crash that the shell will split all over the place. This completed, you are now ready to trial fit the body shell to the chassis, using the chassis nuts and bolts to achieve this.

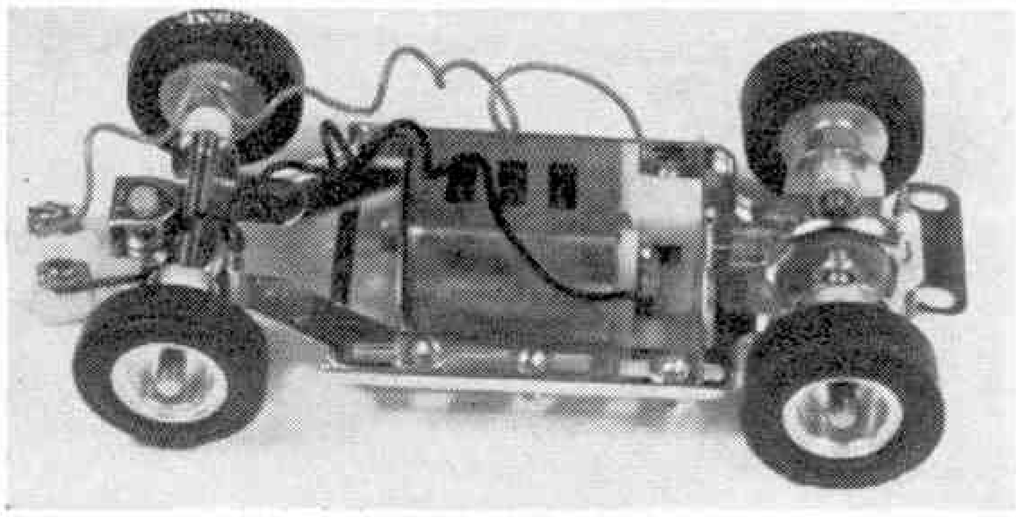
Turn the body shell upside down and pop the chassis into it, taking care to ensure that the slot guide is at the front of the shell! It may sound rather silly to say that, but I have known some people to mount the chassis in the model back to front! Bend inwards the two flaps that were left on the shell between the wheel arches, and with a pin, mark them over each chassis screw. Remove the chassis, open out the holes you marked and dealing with one side of the chassis at a time, remove the nuts. Fit the body shell on to the screws, replace the nuts and tighten them. Repeat for the other side checking that all the wheels revolve freely, opening out the wheel arches with a sharp knife where necessary. You may find that you have to remove some of the wheel spacers and replace with narrower ones if the wheels foul the inside of the shell.

The advantage of a clear body shell is that you can paint it from the inside. This means that the paint and transfers are protected against accidents, as well as looking better i.e. brush marks, unless they are very bad just do not show. The main point when working "inside out" is that the usual operation must be carried out in the reverse order. Transfers must be applied *before* the model is painted. Carefully apply any transfers inside the shell, checking from the outside that they are on straight. Naturally the glue on the transfers will be on the wrong side, and so carefully wash the transfers before applying to remove all traces of adhesive. Slide them into place and allow to dry. Using clear varnish paint the backs of the transfers continuing slightly over the edges, into the body shell. This serves the dual purpose of sticking them firmly into place and also preventing the body colour, when applied, from creeping under the transfers and spoiling them. Next paint in any details like silver bumpers and headlights and red rear lamps, etc.

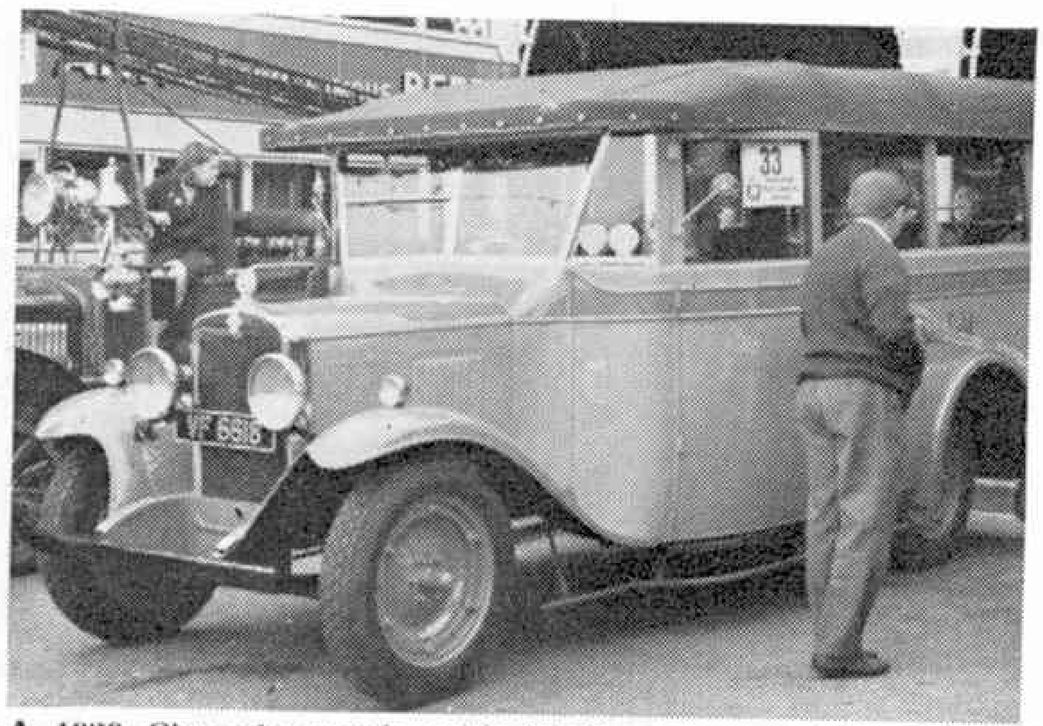
When applying the body colour take great care not to get the paint onto the window areas. You will probably need two coats to completely cover, but *don't* attempt to apply the second coat before the first is dry. To add authenticity to your model you will probably want to fit a driver in. As there isn't much room inside these models in the way of cockpit space, interior details will have to be kept to a minimum. The most popular method used is fairly simple. Get a piece of stiff card and cut it to fit snugly inside the shell, straight across from the underside of the bonnet to the undersides of the boot. This has to be done by trial and error, snipping a bit off at a time and offering it up to the shell to see where a bit more may need to be cut off. When you've got your card cut to shape paint one side of it matt black and leave it to dry. You will need a driver, of course, but only his head! Your local model shop should be able to supply one but don't forget to ask for a 1/32nd scale figure. A 1/25th driver will look ridiculous crammed inside a 1/32nd scale car. Paint his helmet a bright colour, his face pink and goggles silver, then make a small hole in the card cockpit and glue him in. With a drop of white, paint a couple of arms on to the card. A head on its own tends to look a bit lost!

Carefully sellotape the interior into the shell, bolt the body shell to the chassis and your car is now ready to race.

To those of you who may have doubts, I have built nine of these kits to date and not one of them has been disappointing. Most of them are now getting a bit battered looking, but can still show a clean pair of heels to most of the opposition.



The completed chassis with motor, wheels and coiled up motor wires to stop them getting in the way. Note the neatness of this Riko set-up.



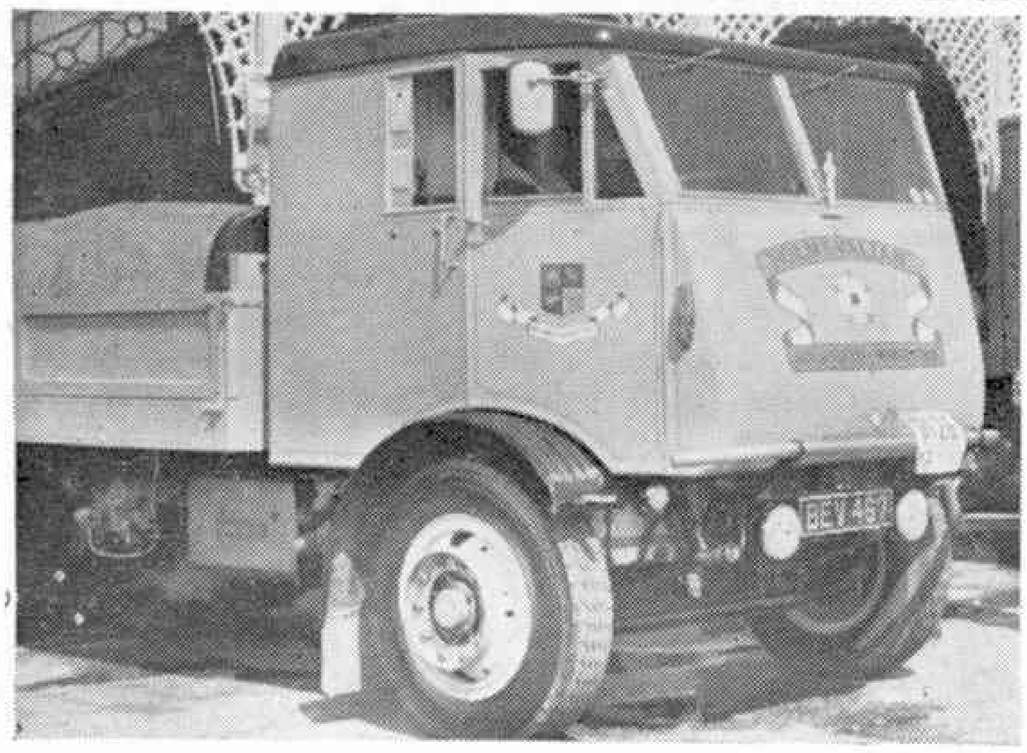
A 1929 Chevrolet coach, with fabric roof, owned by Michael Banfield of S.E. London. Below: A steam lorry of the mid 'thirties.

VINTAGE COMMERCIALS

by John Brewer

MOST READERS of *Meccano Magazine* are fairly well informed on the subject of vintage cars, but how many know of the commercial vehicles of that period? Buses, lorries, fire engines and delivery vans of the time between the two world wars are every bit as fascinating and colourful as the private cars—often much more so.

Every year, the Historic Commercial Vehicle Club organises, in conjunction with the National Benzole organisation, a run from London to Brighton of historic commercials of all shapes and sizes. All these vehicles foregather on Brighton's Madiera Drive, and make a most impressive and colourful line-up, as can be seen from the photographs. Nearly all the commercials which go to Brighton are in private hands, although a few are owned by haulage contractors and coach operators as mementoes of the actual vehicles which started them in business thirty or forty years ago. One of the photographs illustrating this article shows a beautiful little 1929 Chevrolet coach owned by Michael Banfield, of the well-known South London firm of coach operators. The Chevrolet was the forerunner of the Bedford, and was well advanced of its time in the late 'twenties, with its smooth overhead-valve six-cylinder engine. The interior of the coach is beautifully trimmed in patterned moquette, and the fabric roof slides right back for fine-weather touring. Such were the vehicles in which our fathers and grandfathers rode on their seaside "Mystery Tours."



Not only small coaches are preserved by dedicated amateurs; there are several double-decked buses which appear every year at Brighton which have seen service in towns and municipalities all over the country. It is surprising the memories which are stirred in onlookers when they set eyes on an old London K type double decker, with open top and wooden top-deck seats. When you hear a bus conductor shout "Two more outside!" he is using an expression which dates from the early days of open-topped buses. In those days, police regulations *forbade* the use of a closed top deck—we wonder how passengers would react today to such regulations! The K type bus was powered by a four-cylinder petrol engine, and the unfortunate driver did not even have the benefit of a windscreen to protect him from the elements. No wonder bus crews used to wear heavy great coats in the winter.

Although public service vehicles (or P.S.V's as they are usually called) are the most romantic of the vintage commercials, their humble brothers, the lorries and vans, also have an enthusiastic following. Steam wagons are popular, and although the earlier ones are rather picturesque to look at, rather like a cross between a lorry and a traction engine, steam power lasted into the 1930's and later steam lorries were very sophisticated indeed, with smooth multi-cylinder engines and streamlined cabs. If you have never seen a "modern" steam lorry accelerating hard, you have certainly missed something. It is much quieter and less smelly than a modern diesel! One of the photographs shows a steam Sentinel of the middle 'thirties; a fine and impressive vehicle.

Enthusiasts for commercial vehicles who do not have the room available (or the money) to own and preserve a bus or big lorry, usually content themselves with small delivery vans like the early Morris "Cowley" vans and the Morris Minors which were once used in their hundreds by the Post Office. Such small vehicles are much easier to preserve than the "Big 'uns", as they can be used as private cars when they are not being "rallied" at Brighton or elsewhere. Indeed, most of these small vans were based on car chassis, as they still are today.

Most of the people who visit Brighton for the "Commercial" run have very little idea of the enormous amount of work which goes into the restoration of the various vehicles they see. Sometimes a lorry is found mouldering behind a barn in a farmyard, with its engine rusted solid and weeds growing up through the chassis. Such a sight does not deter the true preservationist; the vehicle will be towed back to his workshop (or more usually a lock-up garage) and then the real work starts in earnest. All rusted panels are removed, which is usually a relatively easy job as they are probably half hanging from the timber framework of the "coach-built" cab in any case, and replaced with new ones. The engine is removed and rebuilt, the chassis scraped, cleaned and painted, the brake system overhauled, and sometimes a completely new body built for the chassis. Wings are more often than not in a terrible state, and brand new ones have to be specially made by an experienced panel beater. All this takes time, money and labour, but the result is always worth the trouble: a vehicle which is *almost* as new as it was in the nineteen-twenties or 'thirties.

Above: The American M.109 howitzer tank by Aurora Plastics of Canada. At right: The first six Monogram Merite Miniatures in 54 mm. scale.

KIT #801
W. W. I GERMAN INFANTRYMAN 1914

KIT #802
GREEN BERET

KIT #803
W.W. II GERMAN PARATROOPER

KIT #804
CIVIL WAR UNION SHARPSHOOTER

KIT #805
FRENCH HORSE ARTILLERY - 1810

KIT #806 ROGER'S RANGERS
COLONIAL AMERICA 1756-1760

MILITARIA

by Charles Grant

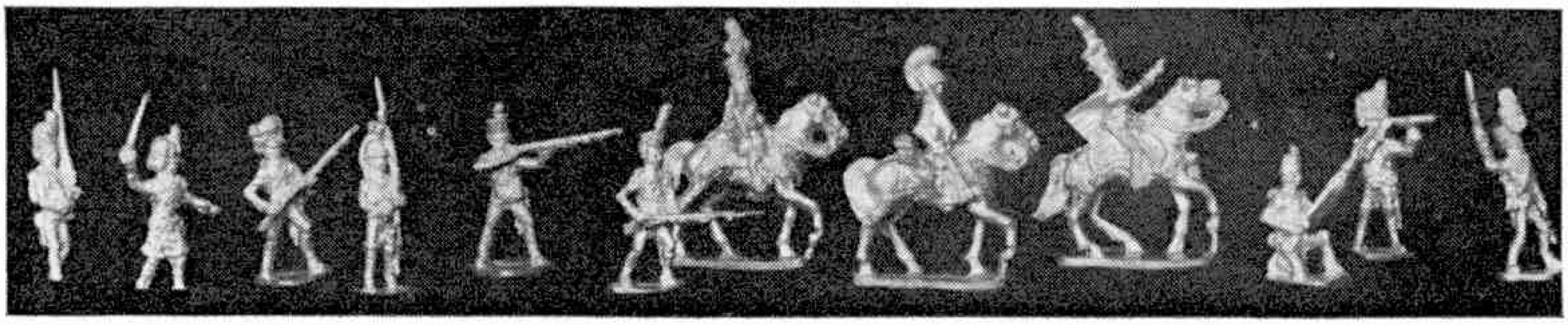
It's only human for people to have favourites and military enthusiasts are no exception. In the realm of plastic military kits I have to confess that one of mine is the U.S. M.109 howitzer tank which, as can be seen, is a most powerful looking job, with its low silhouette and formidable gun. The kit is produced by **AURORA PLASTICS OF CANADA LTD.,** and the very complete assembly instructions are in both French and English. The kit is not a particularly new one but, as I say, it's a prime favourite with me and I offer no excuse for mentioning it. The only slightly adverse comment—and it has nothing to do with the actual kit—is that there is not enough about the history and performance of the actual weapon in the text provided.

Most battlegamers find themselves at some time attracted to the Napoleonic period and many—myself included—actually started with it. Probably the very colourful uniforms and copious literature available has something to do with this, and Napoleonic battles are still probably the most popular with tabletop generals. For them **HINTON HUNT FIGURES** (Marcus Hinton, Rowsley, River Road, Taplow, Bucks) are as meat and drink. Marcus Hinton is one of the ' characters ' of the hobby, and I say this in the most respectful way. Burly and full-bearded, he is a familiar figure wherever military modellers congregate, and his appearance would do credit to any of the Southern generals whose memory he helps to perpetuate in the British Section of the Confederate High Command, a society devoted to the history of ' Johnny Reb.' Not that this really has much to do with his miniatures, which are of both 54 mm. and 20 mm. sizes. It is the latter we are concerned with at the moment and they are as good as anything obtainable. Painted with care they are as fit for the exhibition shelf as for the sterner stuff of the battlegame table. Hinton Hunt figures are in fact a pretty good argument for the theory that it is better to have a smallish army of quality figures than masses of inferior ones. You can see what I mean from the illustration of some of the most recent Napoleonic types—20 mm. of course. Detail and positioning are excellent and historically they cannot be faulted. The price for the unpainted infantryman is 1/10 and for a cavalryman 3/8, but, bought in bulk, the prices can go down as low as 8½d. and 1/7 and you can't do much better than that.

From **MONOGRAM** the famous American firm of plastic kit manufacturers, comes a new series of leaden soldiers—**MONOGRAM MERITE MINIATURES** being the full title. The first brought out by this company, they are 54 mm. in size and the initial six are reproduced, each being illustrative of different periods of military uniform. I have seen the 1914 German infantryman, and he compares favourably with similar British productions, having a certain impressive massiveness. I found little or no flash in the example I saw, general detail and finish are of a high standard, and the completed figure would be a credit to any collector's shelf. The figures come in kit form, ready for assembly, together with a black plastic plinth for mounting the completed article. I must comment on the packaging and presentation, which beats anything I have seen from a British firm. Each model comes in an individual box with a coloured illustration on the front, and the box itself is divided into compartments containing the various bits and pieces, including a gold-finished name plaque, and two tiny tubes of epoxy resin glue for assembling the figure. All this with complete painting instructions, including hints on painting faces. I'm told by the importers (A.A. HALES Ltd., 26 Station Close, Potters Bar, Middlesex) that the price of each figure in this country will be just short of 35/-. Much of this is acounted for, I don't doubt, by duty, tax, and what have you, but, even so, it's quite a lot, when one considers that comparable British figures may be obtained for little over £1. This is rather a pity, as the figures are really rather good.

In recent modelling sessions I have been using a ' Unitool ', a multiple knife produced by **SWANN MORTON**, of Sheffield—the home of steel, of course. This is a very handy device incorporating three variously shaped blades in a metal handle. When not in use they are safely housed in the handle and, in operation, one blade is swung out and locked in position by a screw. The tool is excellent for balsa modelling, and, as the blades are quite stout, it can be used for trimming lead or soft alloy, for carving details in model figures, etc. A most useful appliance.

Below: A selection of the latest battlegame figures by Hinton Hunt—20 mm. types—all of the Napoleonic period.



HUMAN RIGHTS YEAR

by

James A. Mackay

THIS MONTH marks the twentieth anniversary of the Declaration of Human Rights which was promulgated by the United Nations on 10th December 1948. The nations of the world thus pledged themselves to strive for the furtherance of the fundamental freedoms and human rights which had been outlined by the late Franklin D. Roosevelt, in his message to the Congress of the United States in January 1941. The Four Freedoms—freedom of speech and religion and from fear and want—which he evisaged have now been accepted as the minimum of human rights and the Declaration of 1948 sought further to promote social and economic well-being especially among the less fortunate countries.

To this end, the work of such U.N. agencies as the Food and Agricultural Organisation, UNESCO and UNICEF has gone far to bring the aims and ideals of Human Rights to fruition. Nevertheless there are still large areas of the world whose inhabitants enjoy fewer of the rights which people in Britain and the United States take for granted. In an endeavour to focus world attention on the problems which have still to be surmounted the United Nations have designated the twentieth anniversary of the Declaration as International Year of Human Rights.

Many countries throughout the world (a notable exception being Britain) have been issuing special stamps to mark Human Rights Year and no doubt many more will appear during the next few months. Although the mother country has not issued stamps specifically for Human Rights one could include in this theme the 9d. stamp released last June to mark the golden jubilee of votes for women—a fundamental human right which people now take for granted.

Commonwealth countries, on the other hand, have produced some of the most interesting and varied designs which have been released so far. At one time (and not so long ago at that) all the territories controlled by the Crown Agents would have had a set of stamps each, all in the same designs. These "omnibus issues" as they were called became rather unpopular with collectors who regarded them as extremely boring. Consequently sales began to fall, so the Crown Agents decided that henceforward each country would have to issue stamps in distinctive, individual designs. Human Rights is such an abstract concept, however, so that the artists employed by the Crown Agents have had their work cut out to instil variety and interest into these stamps and it says a great deal for their inventiveness and imagination that they have succeeded so well.

Basically they depict the emblem of Human Rights—a flame surrounded by a laurel wreath, but considerable ingenuity has been exercised in incorporating other subjects, often with some local theme. A popular device used to add variety to the design has been the incorporation of the ruler's portrait or a national symbol. Thus the stamps from Abu Dhabi have shown the Sheikh's portrait while the issue from Pitcairn Island features a profile of Queen Elizabeth. Botswana (formerly Bechuanaland) chose the national coat of arms for its set of three stamps.

Nigeria's pair showed the flame emblem beside the national flag (on the 1/6) and a map of the country (on the 4d.)—the latter including the breakaway eastern region of Biafra whose existence is ignored. The motif of manacled hands which also appears on this stamp is perhaps rather ironic in view of the terrible events which occurred in this part of the world during the past year.

The Falkland Islands' quartet showed the flame emblem surmounting a stylised globe of the world. These stamps, incidentally, are the first colonial ones to incorporate the new Machin profile of the Queen which has been adopted for the British definitive series. From Bermuda comes an attractive set of four showing the flame on the globe, with four doves bearing in their beaks ribbons inscribed with the Four Freedoms. Ascension Island's trio showed three chain links being toasted over the flame of freedom—an allusion to the fact that, a century ago, the island was used as a base by the Royal Navy in the interception of slave-ships bound for America from West Africa. Many of the slaves freed by the Navy stayed on Ascension, rather than return to Africa.

Most of the Negro slaves taken to America worked on the plantations in the West Indies so it is not surprising that the countries of the Caribbean area have produced some interesting stamps. The Turks and Caicos Islands showed two hands (one white and the other coloured) cupped below the flame of freedom, flanked by two open books inscribed respectively: MAGNA CARTA, ABOLITION OF SLAVERY, UNITED NATIONS CHARTER and COMMONWEALTH OF NATIONS.

SUPERMARINE SPITFIRE VB FLYING MODEL FOR INDOOR USE!

by Ray Malmström

THIS MODEL of that immortal British fighter—the Supermarine Spitfire—was designed for flying around a pole indoors, but tests proved that is equally at home flying outdoors (on a calm day of course). So when you have built this little semi-scale job you will possess a two-purpose model. If you are not familiar with indoor round-the-pole flying—not to worry—you will find all the information you need in this feature and on the plan.

A note before starting construction. If you intend to camouflage your model (dark green and brown), colour the various parts flat, *before* assembly. We used the new oil-pastels (small box from any art dealer). Apply the pastel to the balsa sheet and then rub lightly with a soft rag to spread the colour evenly. Simple, no weight—and the effect is excellent.

Construction

Cut a length of $\frac{1}{32}$ in. balsa sheet as shown and soak in warm water for 20 mins. Wipe off excess water and wrap around a siutable broom handle or dowel rod. ($\frac{7}{8}$ in. diam. approx.) Hold in position with thread. Do *NOT* use any cement at this stage, otherwise you will not be able to slide the tube off the handle when dry! When absolutely dry remove the tube from the handle. Cut out the formers F1, 2, 3. Open out the tube as shown, and carefully insert the formers in position cementing well. Run cement along the tube join and close. Hold with sellotape until dry. Then cut out and add the top and bottom fuselage pieces A.B.C.D. down the centre lines of the tube. Before cementing part B in position make sure you have traced the wing rib position on *both* sides of part B. This will help you to line up the wing panels later on. Bore 2 small $\frac{1}{16}$ in. diam. holes for the rear rubber anchorage dowel ($\frac{1}{16}$ in. diam.) Reinforce the holes with small squares of brown paper. Carefully chamfer former F1A and cement to F1 (this is important). Construct the propeller nose block and prop. bearing shaft as shown. You can use a 3 bladed K.K. plastic propeller (from your model shop) or a K.K. 2 bladed propeller (5 in. diam.), the tips being removed to give $4\frac{1}{2}$ in. diameter. The completed propeller assembly when fitted into the front of the model (F1, F1A) MUST point DOWNWARDS as shown. Cut tailplane and fin from $\frac{1}{32}$ in. sheet. Note reinforcing strips on underside of tailplane. Assemble fin *after* tailplane. Cement engine cylinders and tailwheel in position.

Cut out wing panels ($\frac{1}{32}$ sht) and wing ribs ($\frac{1}{16}$ sht). Curve the wing panels to the shape of the wing ribs and hold in place with pins until cement has set. Look along wings from tip to root to see the wing panel is not twisted. If so remove the ribs quickly and start again. Note, especially that the root rib on each wing panel is sloped to make the wings slope upwards to the tip when cemented in position. This is called " wing-dihedral ". You should use the root-jig (X) in the way shown in the sketch to get the root rib at the right angle. Take care and it's easy! Bend the undercarriage wire (one for each wing) as shown Fit the balsa wheels (retain on axles with a small piece of close-fitting electrical tubing or blob of cement) and covers. Cement the undercarriage legs in position, reinforcing with small squares of tissue paper cemented in position. Assemble wing panels to either side of piece B using the traced wing rib position to guide you. Check for *equal* dihedral (tilt) on both panels. This completes your " Spitfire ".

Flying

Make up a loop of $\frac{1}{8}$ in. strip rubber 14 in. long and rub on some rubber lubricant (strip rubber and tube of lubricant from your model shop). Install the rubber motor on propeller shaft hook and rear dowel rod. Suspend model from balance point. It must hang *level*. You may need to add a tiny amount of plasticine to either nose or tail. Our original model (the one in the photos) did not need any extra nose or tail weight. This balancing procedure is very important, so do not skip it! Choose a calm day, and long grass for outdoor flight tests. From a gentle shoulder-high launch your model should glide straight and land about 20 ft. away. You can then wind on about 150 turns and try a power-flight. If your model dives, bend up the *rear* edges of the tailplane about $\frac{1}{32}$ in.-$\frac{1}{16}$ in. If it climbs steeply, and then dives in (stalls) add a $\frac{1}{32}$-$\frac{1}{16}$ piece of sheet balsa to the top of the noseblock. Turns are corrected by gently warping the rear part of the fin in the *opposite* direction to the turn. No other trimming should be necessary.

For indoor flying (and this is great fun in the winter, or when the weather stops outdoor flying) make up a pole as shown. Possibly you could build one in your woodwork lessons at school. The line length can be anything from about 5-8 ft according to space available. A large room, your youth hut, or best of all, the school hall (with permission of course!) are all suitable. Wind up the model, and then, attach the line hook to the loop on the wing of your model and let go! If the model will not take off bend the rear edges of the tailplane up about $\frac{1}{32}$-$\frac{1}{16}$ in. If it stalls, add about $\frac{1}{16}$ in. sheet balsa to the top between the prop. block, and F1A.

Do not dope this model

Soak in warm water

Broom

1/16 Dowel

Thread

F3

D

A

C

F1

F2

Sellotape

B

Fl.

D. 1/32 sheet

Blue

White

Red

Brown paper

Light green

Cut out

F3

N.B.
Trace and reverse for port wing panel

C. 1/32 sheet

Join

1/16 sheet

Leading edge

Markings of No.56 Sqdn. R.A.F.

Wing panels 1/32 sheet

Tissue 2 layers

Fin 1/32 sheet.

Blue

Red

R3

Mark with ball pen

X

R2

Under surface

R1

Rib-jig X

R1

R2

Wing assembly

Top

X

To rib

To wing

Dih 1.

SUPERMARINE SPITFIRE V B

DESIGNED BY RAY MALMSTRÖM

R1

R3

Ribs 1/16 sheet

F3

All parts full size

1/32 sheet

Ball pen

Tailplan 1/32 sheet.

R2

owel

Cut out

C

FIA

Tailplane assembly

Wing assembly

FIA

Undercarriage assembly

Fin assembled to rear of fuselage

neet

A. 1/16 sheet

Yellow

Blue

White

Red

F2

Cylinders from soft 1/4" sq.

20 s.w.g.

F1

Winding hook

56

B. 3/32 sheet

Wing rib

N.B. Downthrust angle

Cup washers

20 s.w.g brass bush

1/32 Ply disc

B

Trace wing rib on both sides of piece B.

4

3

2

Balance point

1/32 Ply

1/4 sheet

1/32 reinforcing disc

1

3

4

1

2

20 s.w.g. wire

1/4 sheet

1/4 sheet

1/32 sheet

4.1/2" diam.

Dihedral 1.1/4"

Elec. tube or cement blob

Propeller assembly

3 or 2 blade KK1 plastic 5" dia. prop.

Cut tips off thus to 4.1/2".

Fuselage piece 1/32 sheet

Nail

20 s.w.g wire

5' 8"

2' 6"

1"

Flight path

F3

F2

F1

5"

1/2"

F2

1/16 sheet

3/32 sheet

F1

Power

1 loop 1/8" strip

14" long max.

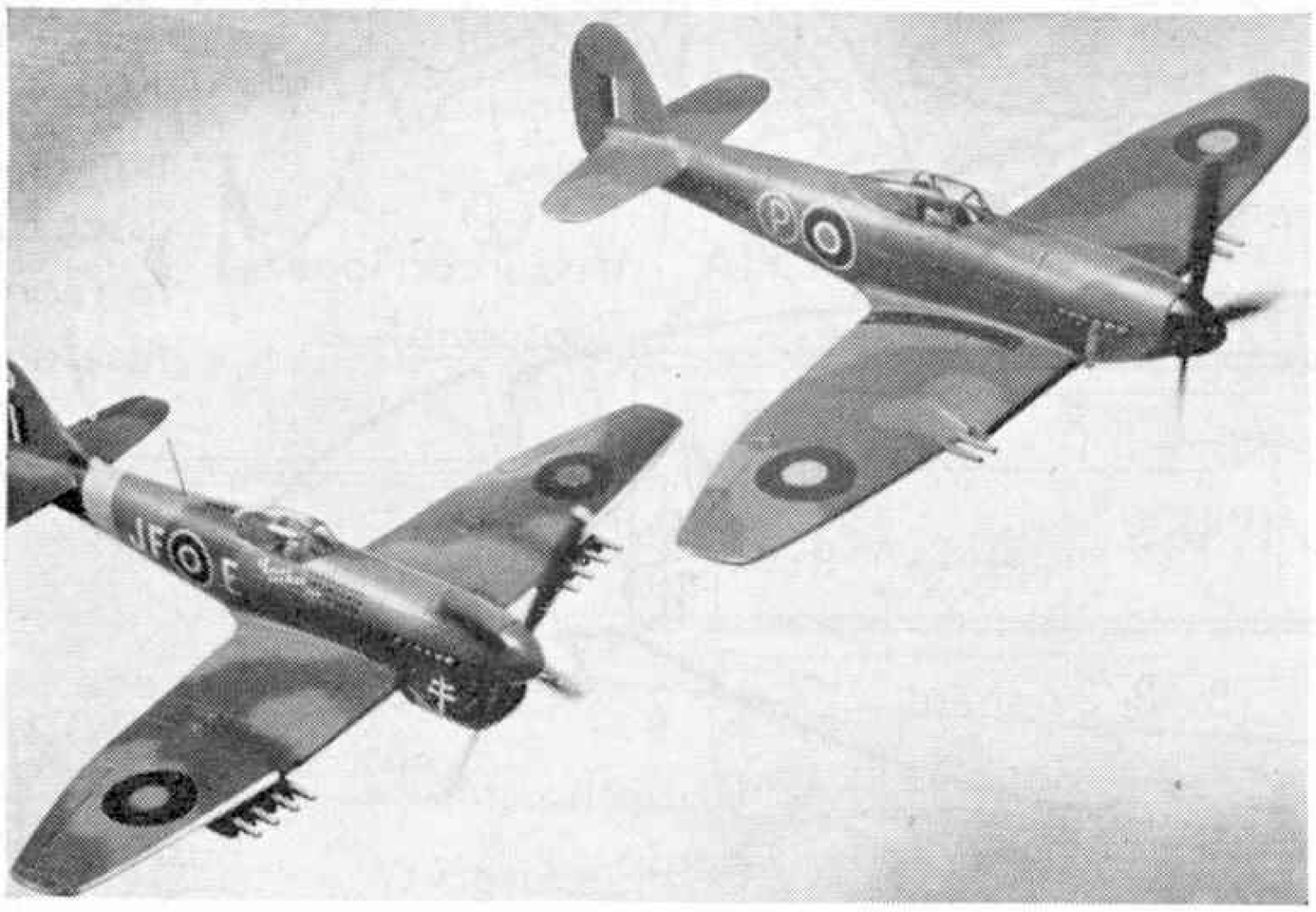
No. of turns (lubricated) and run in: 1,250

FIA

Chamfer thus

12" sq.

Pole details



WORKING WITH PLASTIC

by Doug McHard

MODERN PLASTIC kits present, with very few exceptions, an extremely straightforward assembly job, and even the novice can, with a little care, produce an acceptable model by simply following the kit instructions.

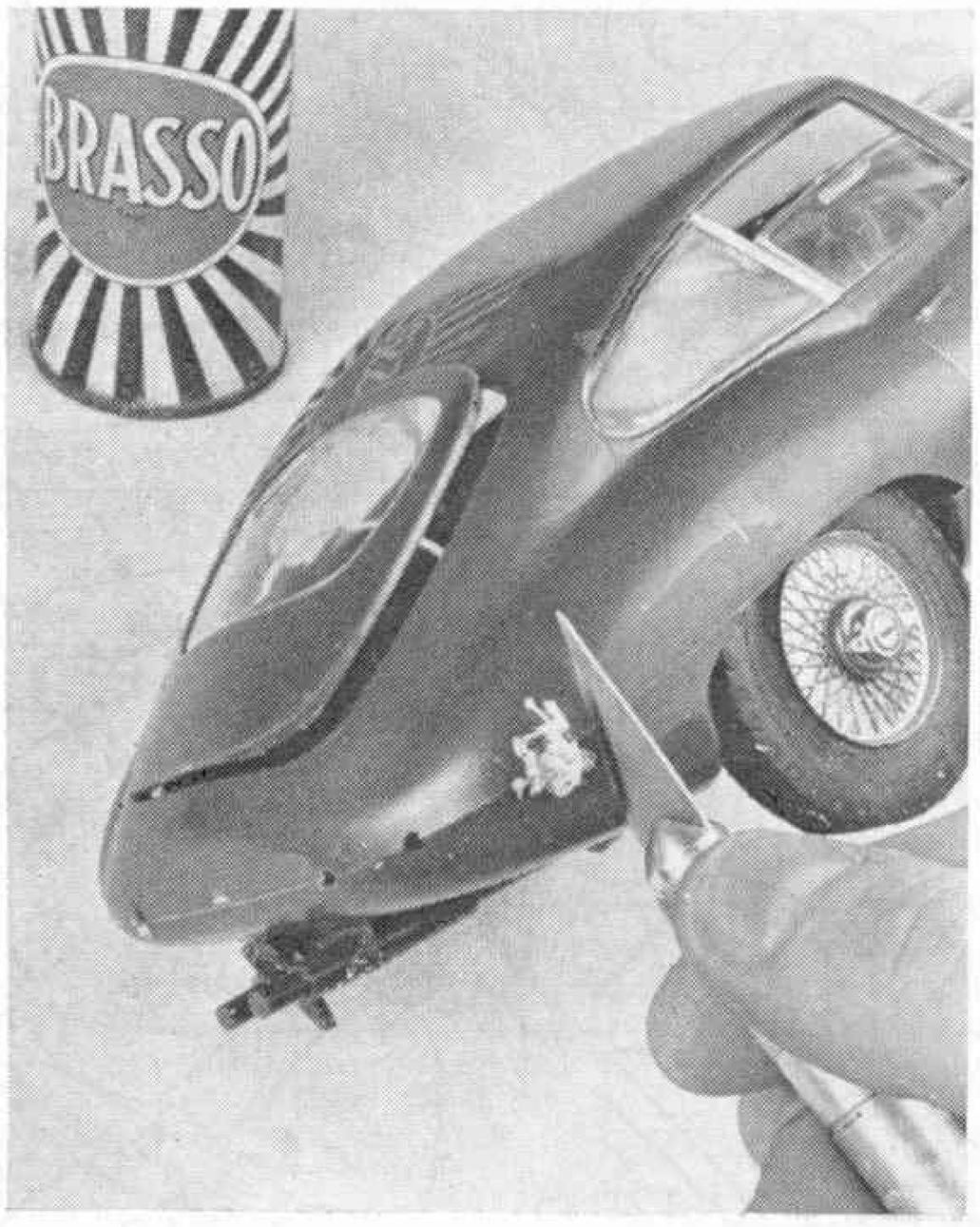
Thousands of pounds are spent by kit manufacturers to ensure the highest possible quality consistent with a realistic selling price, and yet, despite the near perfection of the moulded pieces, there are still lots of things the modeller can do to alter and further improve the appearance of the finished model.

A simple model will not ultimately give you the degree of satisfaction, and sense of pride in achievement, that you may justly claim for a more complex project. When the basic skills have been acquired you will certainly want to progress to the challenging projects of the experts.

The desire to make your own model as individual and distinctive as possible is a natural one in an age where mass production methods are inevitably tending to reduce individuality. Like the car owner whose pride and joy is just the same shape as half a million others, the plastic modeller's first thought is perhaps to change the colour scheme in some way. A number of excellent books and periodicals are available which give colour and insignia variations, some quite easy to execute and others so complex that the finished model becomes, quite literally, a work of art.

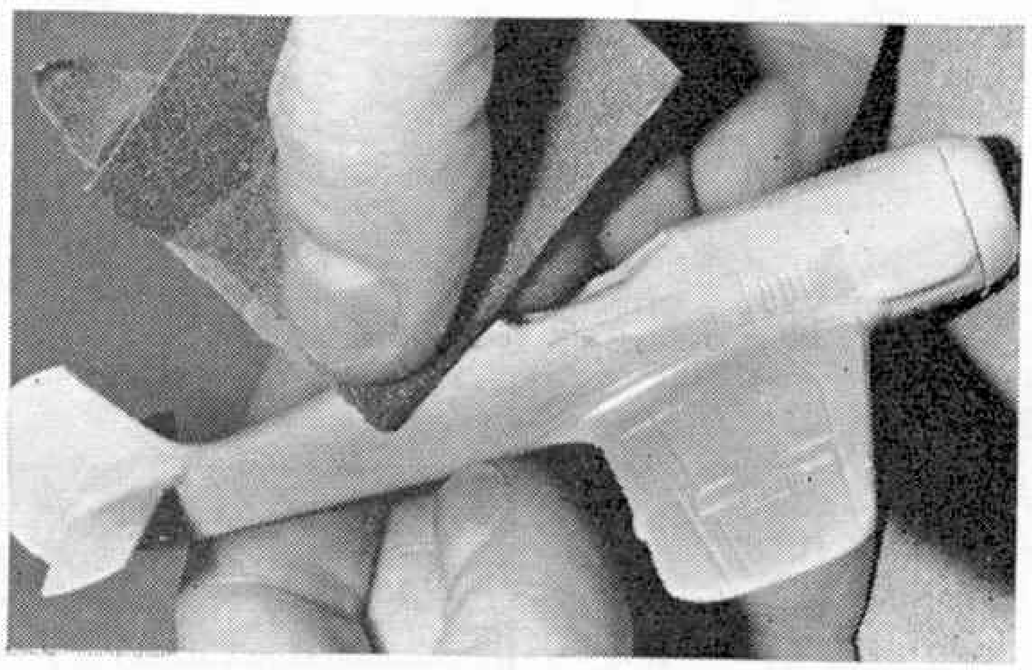
But for those of us whose skill with the brush leaves a lot to be desired, the physical modification of an aircrafts' outline is often the more attractive pro-

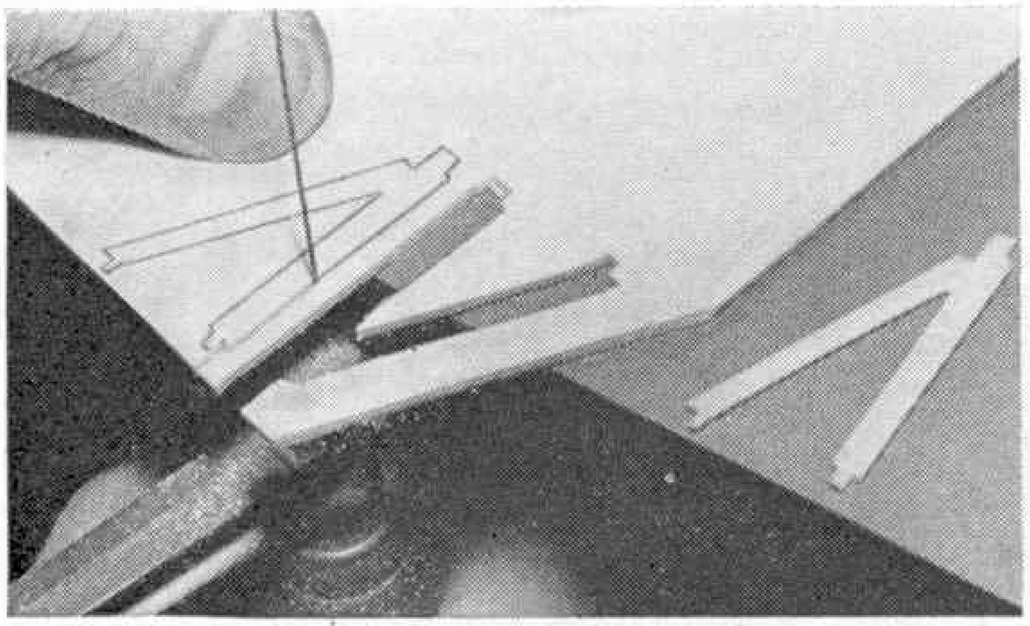
Above: Simulated "in flight" picture of a standard Frog Hawker Tempest V (foreground) in formation with a Tempest 11 modified from the same basic kit.



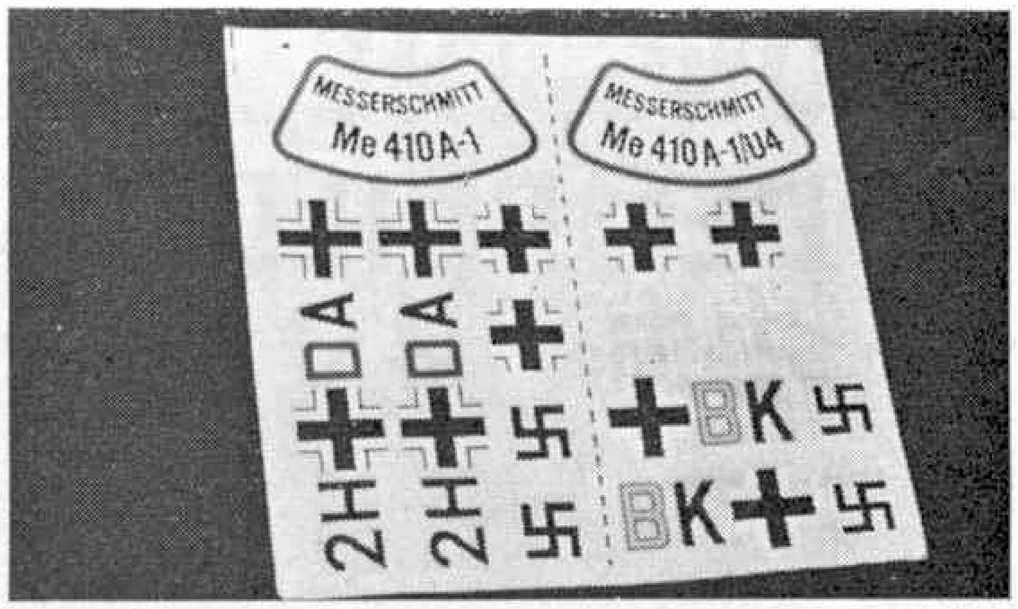
At left: Joint lines between mouldings usually produce an unwanted ridge. When the cement has thoroughly dried (it may take several hours) scrape the joint with a sharp knife held at right angles to the surface. Restore the polish with Brasso rubbed on with the fingertip and then buffed with a soft cloth.

Below: Body putty specially made for the job is very useful for filling in too-deep engraved lines. It should be spread on with a knife (just like butter) and when dry smoothed down with No. 280 and then No. 400 grade wet-or-dry abrasive paper (used dry). Imperfect joints can be made good in the same way.





A fine jewellers saw (like a small fretsaw) is very useful for cutting complex shapes, like these struts from sheet styrene.



Transfer sheets frequently offer alternative markings. There will be several unused ones—keep them—they will be handy.

position. The aeroplane has yet to be made which remains unaltered throughout its career; in fact, a machine is often changed so extensively that its whole character is transformed.

Perhaps one of the more fascinating aspects of this hobby is that of seeking out information on some obscure design variation. You will inevitably become a 'photograph magpie' and your files of strange flying shapes will increase with surprising speed. A visit to the local reference library and a browse through the aeronautical section will frequently give inspiration for a new project and set a frantic search in motion for more information.

Such infinite variety offers the modeller seeking originality the greatest scope and satisfaction. Very few tools are generally needed to carry out even quite advanced 'modding', but the essential requirements are patience and a willingness to experiment.

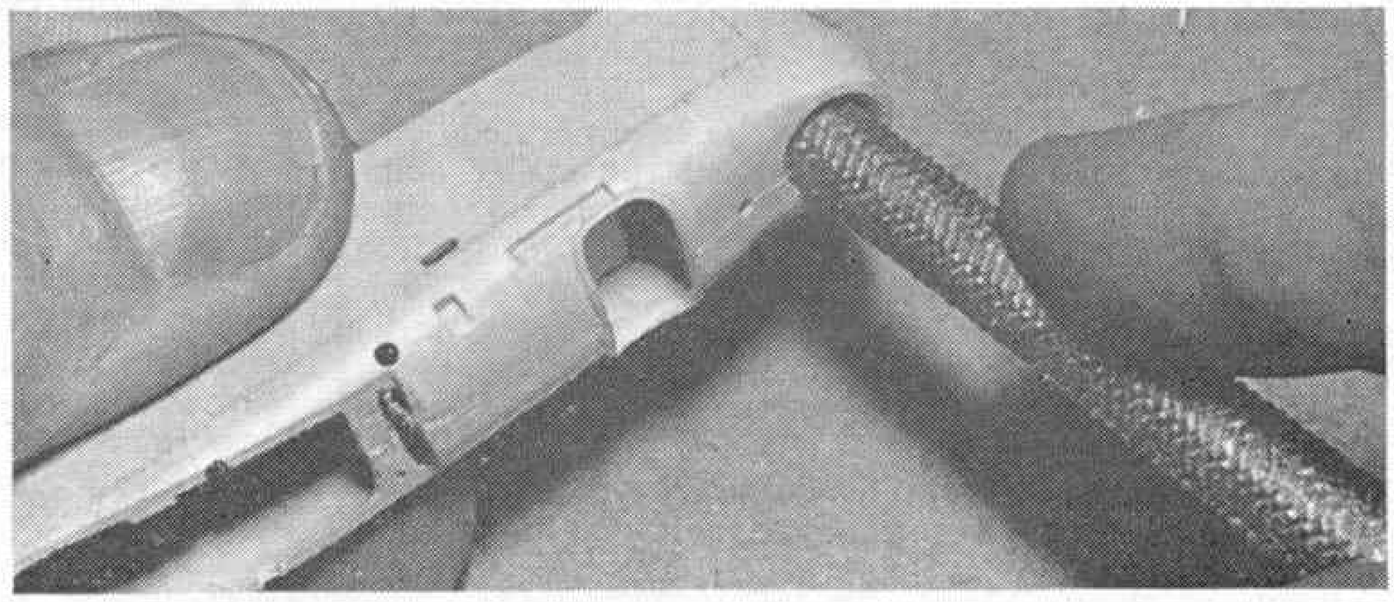
On these pages you will see photographs of some basic operations which can be adapted to many 'modding' requirements. Several recent kits already offer the builder the choice of assembly in two or even more forms to represent alternative types. Some may also be assembled with undercarriages retracted or extended. In these cases you will most likely be left with a number of unused parts such as wheels, transfers, bombs and so on. Never throw these bits away, but carefully preserve them in a Spares Box.

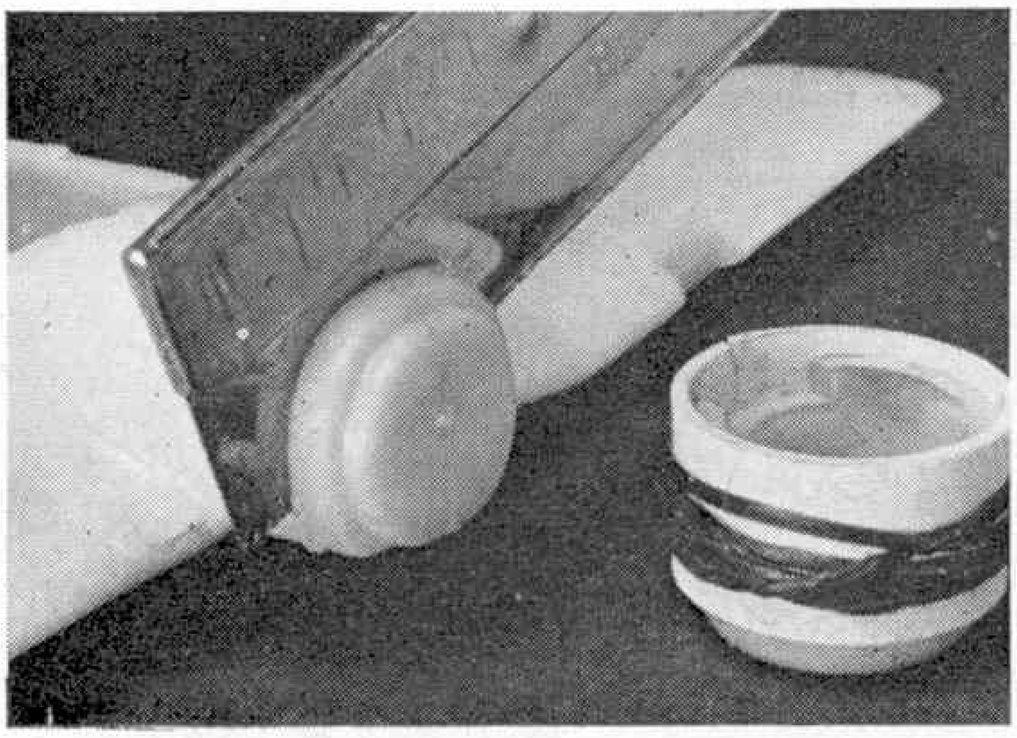
This, in time, will become as indispensable to you as your picture reference files and will be increasingly 'raided' as your 'mods' become more advanced. Quite often the bits left over from one kit will inspire the conversion of another model as we shall see in later articles when we come to specific projects. Even the plastic 'sprues', as the moulding stems are called, will be found useful so keep these as well.

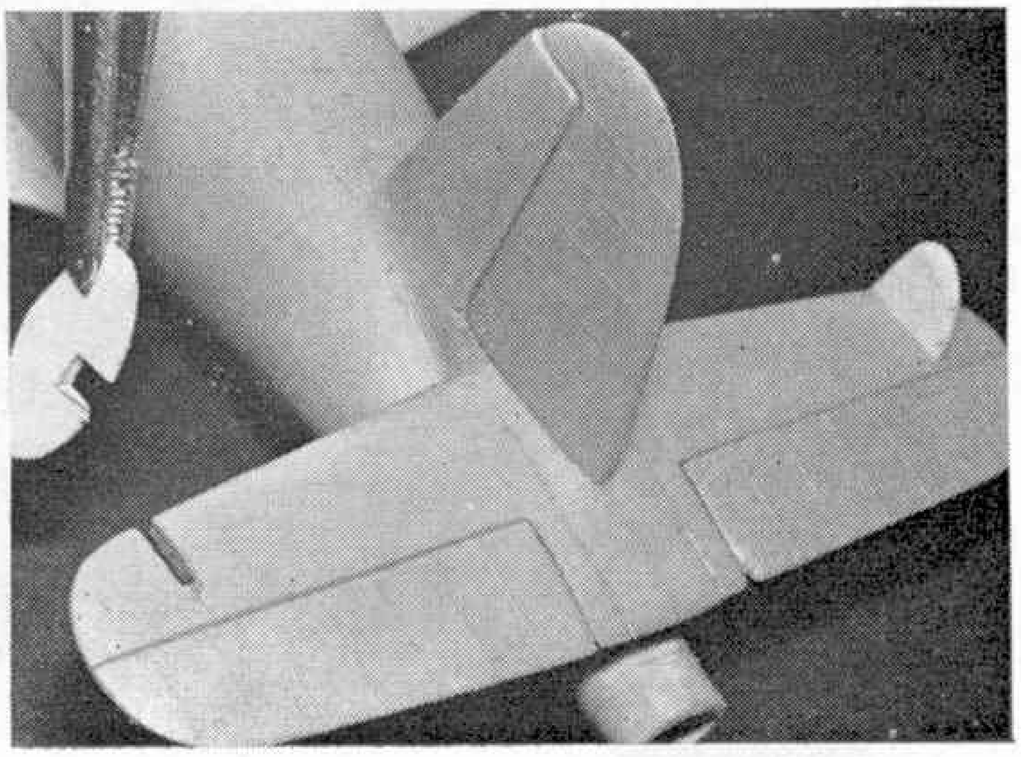
At right: Files—both flat, round and three-square will be useful. Cheap ones are quite good enough for use with polystyrene plastics.

Below right: Tweezers are indispensable for the effective handling of small parts. Tools like those shown on these pages last a lifetime and are a once-for-all investment.

Below: A Razor-saw makes short neat work of plastic cutting jobs where straight cuts are needed. This one is from the X-Acto range of tools.







AMONG THE MODEL BUILDERS

with Spanner

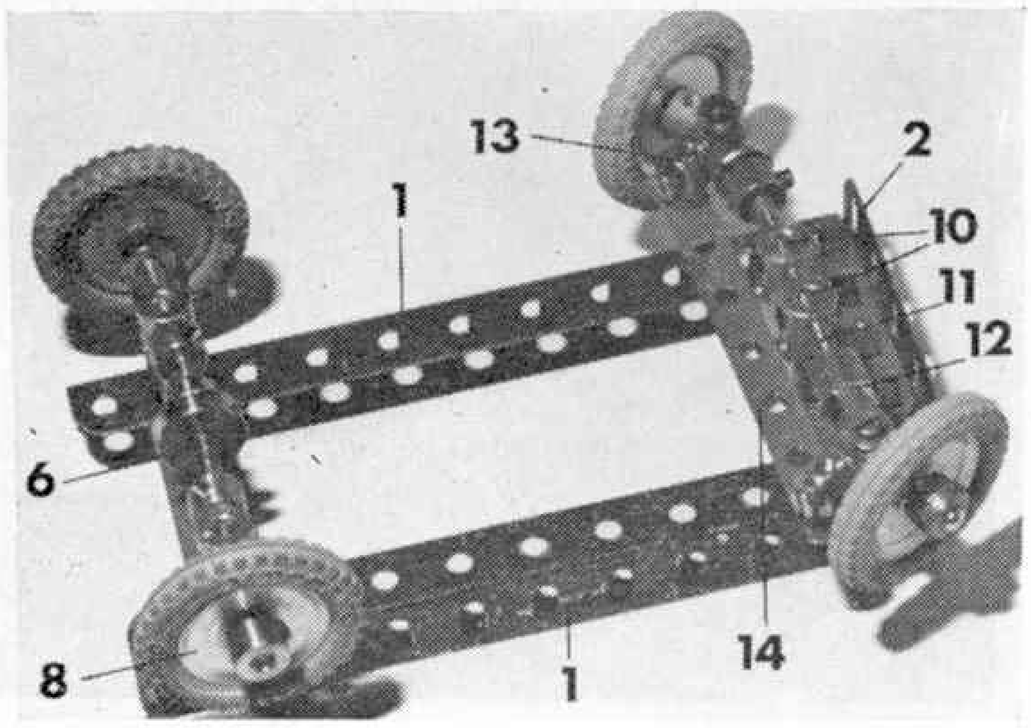
Light-duty Clutch

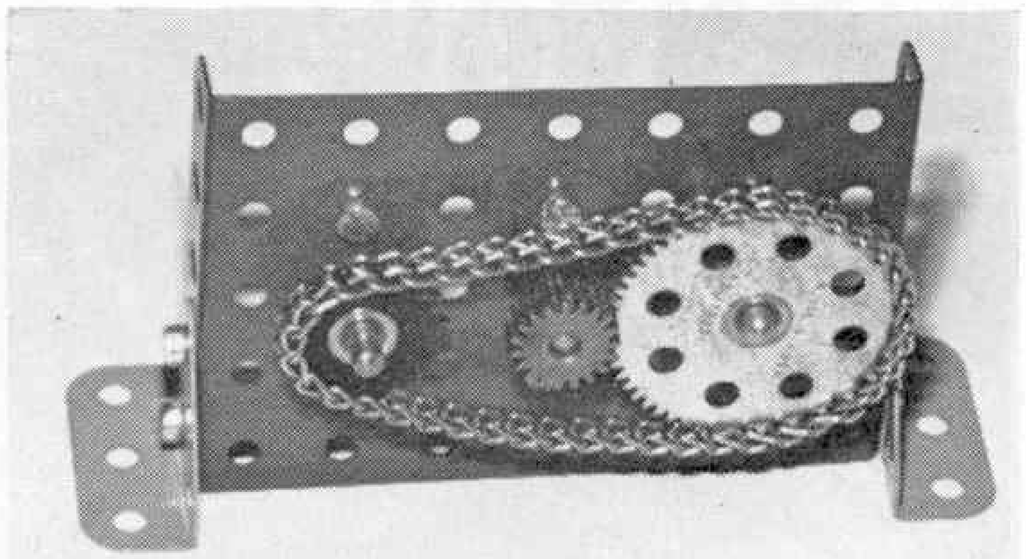
WE BEGIN this month with Clutch from Norman Tudor of Prenton, Birkenhead and is one of the best light examples of this type of mechanism I have seen produced in Meccano. As illustrated, the unit is built up from a $5\frac{1}{2} \times 2\frac{1}{2}$ in. Flanged Plate to which two $1 \times \frac{1}{2}$ in. Double Brackets 1 and 2 are bolted. Double Bracket 1 provides the bearings for the input shaft 3 on the inside end of which a 57-teeth Gear Wheel 4 is mounted. Collars hold the Rod in place.

In the case of the output shaft 5 (held by Collars in Double Bracket 2) this is fixed half-way into the longitudinal bore of a Coupling 6, in the other half of which a $1\frac{1}{2}$ in. Rod is *loosely* mounted. This Rod carries, in turn, a Compression Spring 7 and two 1 in. Fixed Pulleys 8 and 9, the latter fitted with a Rubber Ring and positioned on the end of the Rod. The action of the Compression Spring on Pulley 8 should force the Rod outwards so that the Rubber Ring on Pulley 9 is held tight against the face of Gear Wheel 4. Guides controlling movement of the Rod are provided by two Fishplates 10 mounted on Bolts which pass through the circular holes of the Fishplate and are screwed tight into the tapped bores of Pulley 8. Inserted through the elongated holes of the Fishplates are further Bolts, each carrying a Washer, which are screwed into the end transverse tapped bores of Coupling 6, Nuts on the Bolts preventing them from fouling the $1\frac{1}{2}$ in. Rod.

Any suitable clutch lever can be incorporated, but, for demonstration purposes, I added the rather cumbersome example featured in the illustrations. Two $2\frac{1}{2}$ in. Strips 11 are connected by a $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip 12, the securing Bolts also fixing a Crank 13 in place in each case. The Strips are then locknutted one to each flange of the Flanged Plate. Two $1\frac{1}{2}$ in. Rods held in the bosses of the Cranks locate between Pulleys 8 and 9.

Just before moving on, I should like to add that a Bush Wheel or a 50-teeth Gear could be substituted for the 57-teeth Gear if particular circumstances require it.





PARTS REQUIRED

2—5	1—18a	10—37b	3—59
2—10	2—22a	2—38	2—62
2—11a	1—27a	1—48a	1—63
2—16	10—37a	1—52	1—120b
			1—155

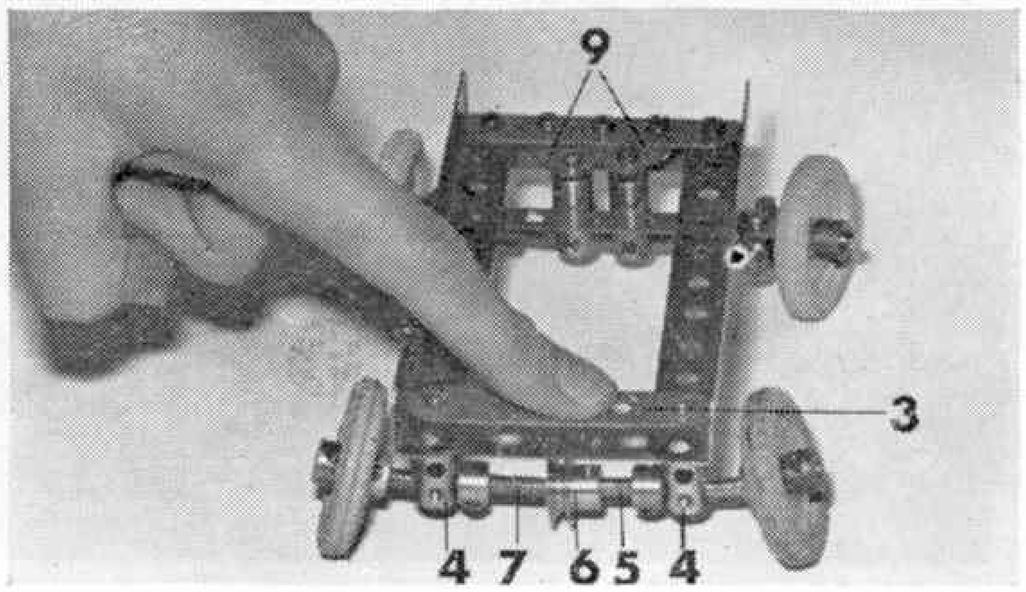
Gear-to-Sprocket Drive

Our second offering is a Gear-to-Sprocket Drive system, this was supplied by R. G. Edwards of Sandbach, Cheshire who describes it as ". . . . a compact method of transmitting a gear drive onto a Chain/Sprocket Wheel system." You will see from the accompanying illustration that the mechanism is highly simple being little more than a 57-teeth Gear Wheel coupled direct to a $\frac{3}{4}$ in. Sprocket Wheel. I know this is not standard engineering practice, but I must confess that, in this case, it does work extremely well and so I see no reason why the idea should not be used.

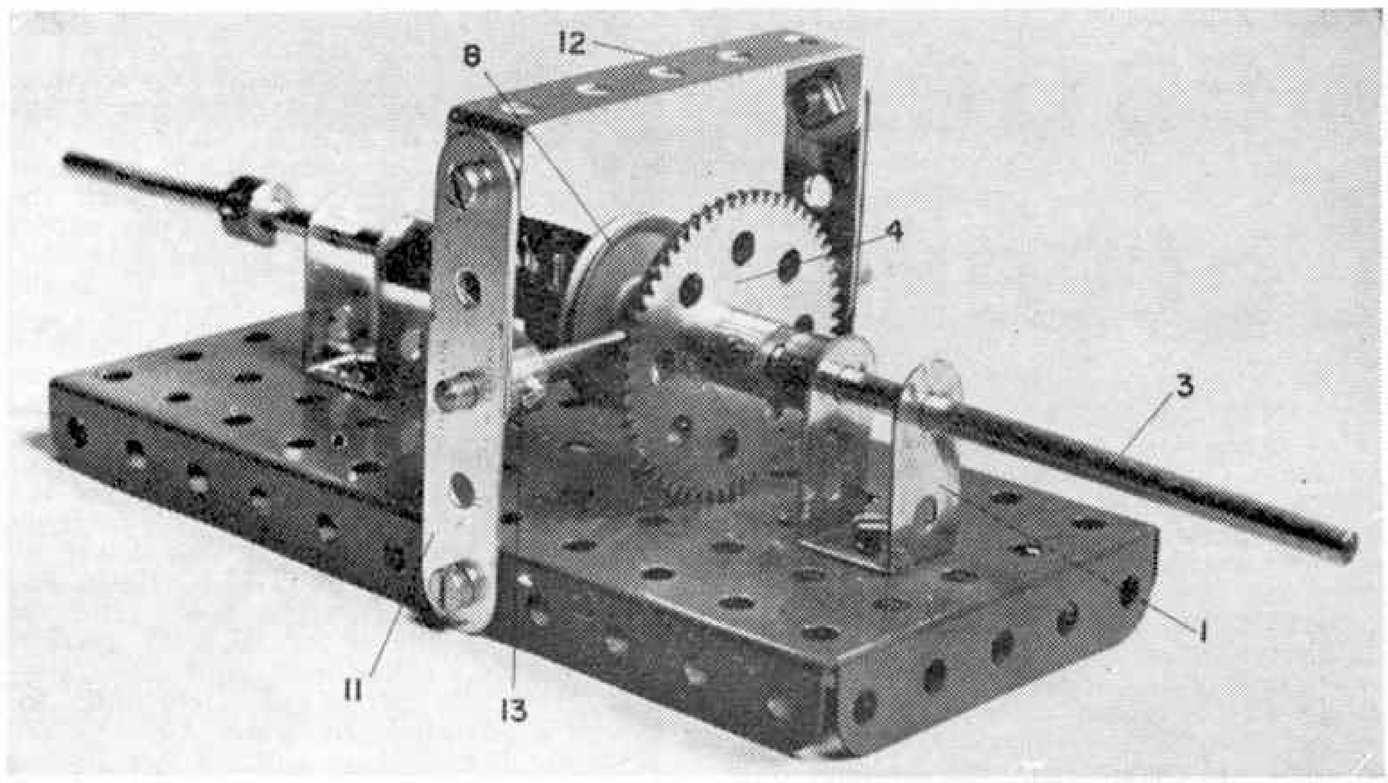
The unit as illustrated was built purely for demonstration, but, as the layout of the important parts, when the idea was applied to a model, would depend entirely on the construction of the individual model, there is no point in describing construction of the demonstration mechanism here. Suffice it to say that, under operating conditions, the 57-teeth Gear 1 would be the final output-drive Gear of the specific gearbox in use, the Gear, itself being driven by $\frac{1}{2}$ in. Pinion 2. Rod 3 would then be required to transfer the drive to elsewhere in the model, therefore $\frac{3}{4}$ in. Sprocket Wheel 4 is connected by Sprocket Chain direct to the Gear Wheel 1. As I say, it certainly works.

You will probably be wondering, however, why we should not follow normal Meccano procedure and mount another Sprocket Wheel on the Rod carrying Gear Wheel 1. Mr. Edwards himself answers this

A simple, but extremely effective suspension system, using Flexible Coupling Units, supplied by James Grady of Dundee, Scotland.



At right: A compact Light-Duty Clutch designed and built by Norman Tudor of Prenton, Birkenhead, Cheshire.



At left: It may not be standard engineering practice, but this idea for driving a Sprocket Wheel by Chain from a Gear Wheel works extremely well. It came from R. G. Edwards of Sandbach, Cheshire.

one. "In a gearbox which is small or intricate, and which must use a Chain for its final drive," he says, "Fitting a Gear Wheel (to take the Gear drive) on the same Rod as a Sprocket Wheel may be awkward, especially if the Rod is a small one."

Simple independent suspension

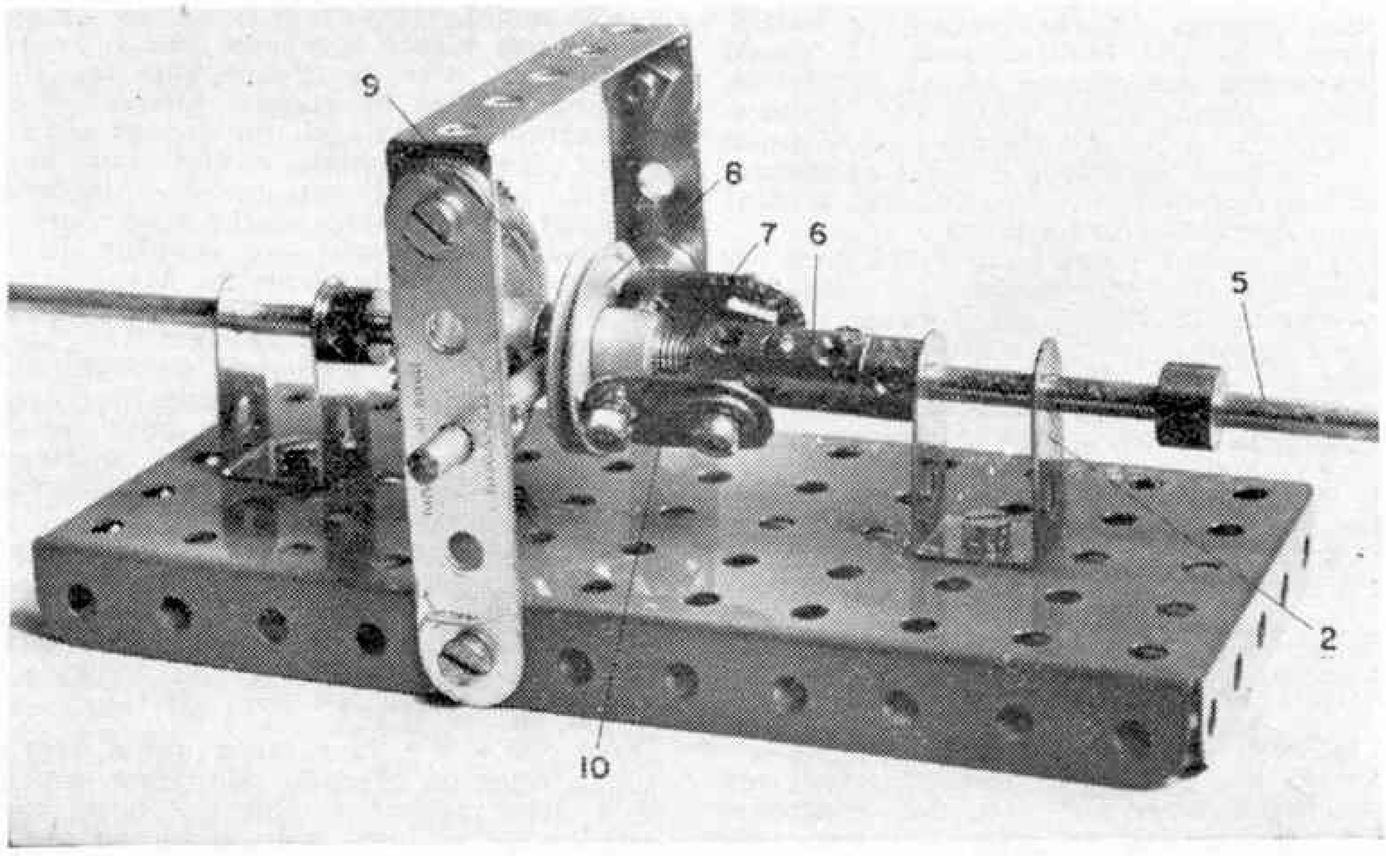
On a different subject, James Grady of Dundee, Scotland in a recent letter to me said, "I have often looked at the Flexible Coupling Unit, Part No. 175, and I feel that it is the "orphan" of the Meccano system as it is so seldom used and yet it has so many uses." He is, of course, quite right. The Flexible Coupling Unit doesn't often appear in models and yet it can be invaluable. To prove this point, Mr. Grady has sent me a sample construction illustrating one use of the Part—in a simple independent suspension system for small motor vehicles.

Naturally, the layout of the system would vary with the model to which it was fitted, but the test sample illustrated consists of a chassis built up from two $5\frac{1}{2}$ in. Angle Girders 1 joined at the front by a $2\frac{1}{2}$ in. Angle Girder 2 and at the rear by a $2\frac{1}{2}$ in. Strip 3. Two $\frac{3}{8}$ in. Bolts with Nuts are used to secure Strip 3, a Threaded Coupling 4 then being screwed onto the shank of each Bolt. Journalled free in the lower transverse bore of one of these Couplings is a Flexible Coupling Unit 5, held in place by a Collar and also fixed half-way into the bore of a $\frac{1}{2}$ in. Pulley with boss 6. A second Flexible Coupling Unit 7, held by a Collar in the lower bore of the other Threaded Coupling, is inserted into the remaining half of Pulley 6. A 1 in. Pulley with Motor Tyre 8 is fixed on the free end of each Flexible Coupling Unit.

Moving to the opposite end of the chassis, two 1 in. Triangular Plates 9 are bolted to Angle Girder 2 and to the apexes of these, two $\frac{3}{8}$ in. Bolts are fixed by Nuts. As before, two Threaded Couplings 10 are screwed onto the shanks of the Bolts, a third Flexible Coupling Unit 11 being fixed in the lower transverse bores of these Couplings. Two Swivel Bearings 12 are mounted one on each end of the Flexible Coupling Unit, the "spider" of each Bearing carrying a 1 in. Rod on which a free 1 in. Pulley with Motor Tyre is held by a Collar. Screwed into one tapped bore of the Bearing's spider is a $\frac{3}{8}$ in. Bolt which carries a Washer and a Collar 13, then Collars 13 at each side are pivotally connected by a $3\frac{1}{2}$ in. Narrow Strip 14. When built into a model, the steering linkage would be taken to this Narrow Strip.

PARTS REQUIRED

1—5	4—22	4—38	6—111c
2—9	1—23a	8—59	4—142c
1—9d	11—37a	2—77	2—165
1—18b	7—37b	4—63c	3—175
			1—235b



Another view of the Clutch showing the input shaft. The 57-teeth Gear 4 could be replaced by a Bush Wheel or a 50-teeth Gear if necessary.

Readers' Letters

Generous coverage

DEAR SIR,—On behalf of the Midlands Meccano Guild I would like to express the sincere thanks of all its members for the Editorial in the August edition, giving such generous coverage to the report on our March Meeting. It was, indeed, a further great success and the publicity given to Guild activities by your magazine, has contributed in no small way to the growth and enthusiasm among the membership. It is no exaggeration to say that the world wide circulation of *Meccano Magazine* has put enthusiasts abroad in touch with our activities and promoted a stimulating correspondence among members. They are very pleased with the new developments and contents of the current magazines which they feel are putting *Meccano Magazine* back into its rightful place as chief organ of an international hobby which has survived the ravages of time and change.

As there are two well meaning errors in your Editorial which arise from my original report, I would be most grateful if you would correct them for the sake of the record. The phrase 'a ton and a half of solid Meccano' must be taken with the proverbial pinch of salt—Guild members know by now that my reports and Newsheets often contain such outrageous embellishments and know how to read the true meaning. For the sake of your readers, suffice it to say that Eric Taylor's Ford Transit was packed to the doors with the models of the Rugby and Nuneaton contingent!

Finally, the reference to Dennis Perkins' Tower Crane of early vintage should be associated with manuals of the 1914 period and not 1940 as printed. I do apologise for any error of mine in the matter. *B. N. Love* (Hon. Sec.).
61 Southam Road, Hall Green,
Birmingham 28.

Greater Honours

DEAR SIR,—I wish to answer two counts which were raised in your August edition of *Meccano Magazine*.

Firstly, in response to the plea by Mr. A. R. Barron of 64 St. Augustine's Terrace, Halifax, Yorks, regarding battlegamers in the Halifax area. I would advise him to write to Mr. E. P. Smith of 90 Burrage Road, Plumstead, London S.E.18, as he is at present engaged upon compiling a complete list of wargamers in the British Isles. He also has a complete list of wargame clubs.

The second point is to thank you for your kindness in reviewing my magazine Miniature Warfare, but I must correct the suggestion made by Charles Grant in that Miniature Warfare is the organ of the London Wargames Section. Charles Grant, is in fact giving Miniature Warfare greater honours than it has achieved. It is a private publication for persons interested in tactics and weapon capabilities and is not the official organ of the London Wargames Section.

John Tunstill (Editor).
61 Benares Road, Plumstead,
London S.E.18.

Putting it right

DEAR SIR,—I have just received my August edition of *Meccano Magazine* and am writing to point out some inaccuracies in your articles on the Royal Navy and Fleet Air Arm.

The photographs on page 420—caption reads that a Sea Vixen Mk1 approaches the flight deck of H.M.S. Victorious, the letter 'R' on the round down identifies this carrier as H.M.S. Eagle, also the square stern, Victorious being an earlier design her stern was much narrower, coming down to the base of a 'V' at the waterline.

In the article on "The Ultimate in Surface Warships", John Mannering states that 'The British Navy entered the war with six carriers—Pegasus, Furious, Argus, Ark Royal and Hermes'. Pegasus was listed as a seaplane carrier—my father was serving on H.M.S. Courageous before she was torpedoed and I see no mention too, made of H.M.S. Eagle and Glorious, no mention was made either of the work of the other W.W.II carriers Indomitable, Implacable and Indefatigable, also the period of Victorious' rebuilding spanned the years 1950-58 not 1950-60, I helped to rebuild her during this time.

However, I think *Meccano Magazine* in its new form is a great improvement on the one I knew as a boy, so I will close wishing you every success with *Meccano Magazine*.
Portsmouth. *Raymond P. Johnson.*

DEAR SIR,—Reference to photo, and caption, on page 139 of March 1968 issue of *Meccano Magazine*, in the article on "Solar Energy", I feel the reference to a New Zealand Solar Operated water distillation plant, is really a 'solar hot water system', thousands of which are used in Australia for domestic home hot water, especially here in Western Australia where it has been estimated that only on about 7 days in the year it is not possible to have hot water on tap, through the use of these solar heaters, at no cost for fuel. Solar Energy will heat the water even on cloudy days. On such days, when the sun is out, usually an electric heater element boosts it to correct temperature.

With best wishes for continued future of *Meccano Magaizne* (I started reading it in 1929).
West Australia. *J. Stanbridge.*

Canals

DEAR SIR,—Very sincere thanks to all concerned with the production of the new *Meccano Magazine* which I find very similar to the magazine of former years.

I am not sure exactly when I bought my first-ever *Meccano Magazine*, but the front cover carried a picture of a large Lift Lock (in Germany, I think).

It would, I appreciate, be most difficult to please everyone, but I would particularly like to thank you for including articles of general interest (e.g. shipping, railways and the current article about Youth Hostels "Get out and About") as well as purely Meccano subjects. Please keep up the good work.

Incidentally, could we possibly have sometime an article about the Manchester Ship Canal? I live about two miles from this very interesting waterway, and often watch ships passing through the locks at Latchford, Warrington, but perhaps many of your readers have never seen it and would no doubt welcome such a subject. Best wishes and success to the *Meccano Magazine*.
Warrington, Lancs. *E. Critchley.*

We have a specially written feature on canals to hand already for use in a future issue of the magazine.—Ed.

Most interesting

DEAR SIR,—We have taken out a year's subscription on *Meccano Magazine*, which is a great favourite with the boys, the articles are all well written and of great interest. For my own part, a grateful thank you for the 'Militaria' reviews by Charles Grant, let us have more of these, please, they are most interesting and helpful with the names and addresses conveniently placed in the text. Perhaps, Mr. Grant might give us some details of the splendid collector's pieces made by 'Regimental' of London; although the prices are beyond the pockets of ordinary boys, I am sure that they would like to know something of how they are made.

Kenneth R. Kendall.
Ashbourne County Secondary School.

Wrong way

DEAR SIR,—I am a battlegamer and I read the articles by Charles Grant. I think they are very good, but I have a small point to make on the subject of averages. The idea is good but I feel that he handles it the wrong way. Instead of halving the speed he should take two-thirds. For example, a Sherman can move 12 ins. which represents a speed of 12 m.p.h. by his rules, but by mine its maximum move is 16 ins. It may move only three inches of course.

In order to allow an extra burst of speed when under fire, it is given an extra third of its original speed, every third move. Thus a Sherman moves 16 ins. twice and then 24 ins.
Wigan, Lancs. *C. Brookes.*

Grant replies

DEAR SIR,—I am delighted that Mr. Brookes approves of my "Battle" articles.

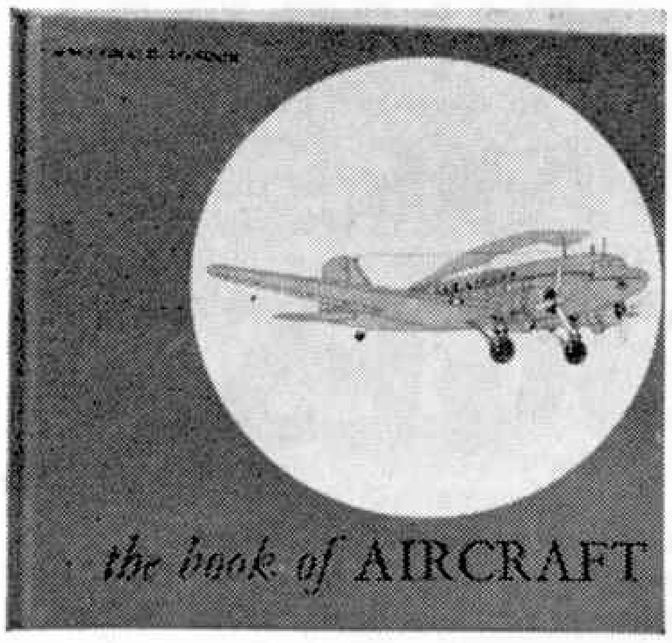
Now, as to his first point—that is, my making the tank speed one-half of maximum specification speed, instead of two-thirds, as he does—it is, like so much in the battlegame world, a pretty personal matter, but I feel that he is being overgenerous. What we are thinking of, I assume, is a battle speed, with the vehicle both moving and firing. Now, anyone who has travelled at speed in a tank across country will agree that the first—indeed the only requisite—is to hang on for dear life—the sensation is akin to that of a pea in a violently agitated tin can. As to fact, the Americans, with transatlantic thoroughness, have done numerous tests on their proving grounds. I am assured that what emerges is that the maximum speed at which a tank gun can be fired is 8, 10 and 12 m.p.h. for 20, 30 and 40 m.p.h. vehicles respectively. With the Sherman (mentioned by Mr. Brookes) having a maximum speed of 24 m.p.h., I calculate that its greatest firing speed would be about 9½ m.p.h.—a rough average of my two battle speeds—across country and on roads—of 6 and 12 m.p.h. (or moves of 6 in. and 12 in. on the table). I feel that, in giving his Sherman a battle move of 16 in.—equivalent to 16 m.p.h.—he is being rather optimistic. I don't give his gunner—travelling at this speed—much chance of hitting a target.

The second point—that relating to an occasional burst of speed—is a very valid one. The disadvantage of writing about battlegame rules in a series of articles is that, perforce, one must first discuss basics and leave refinements until later. One of the latter will, of course, be the use of an occasional "burst of speed" when the demand for it is imperative.

By I know not what mischance, in my letter to you regarding a certain recent book, I referred to it as "Challenge", when, of course, it should have been "Charge". I apologise most humbly to the authors, as I do to Mr. Rene North ("Paint Your Own Cards") for giving him an old address, when in fact it should have been 3/53 Blackheath Park, London S.E.3.

Mea maxima culpa!
Dover, Kent. *Charles Grant.*

RECOMMENDED READING

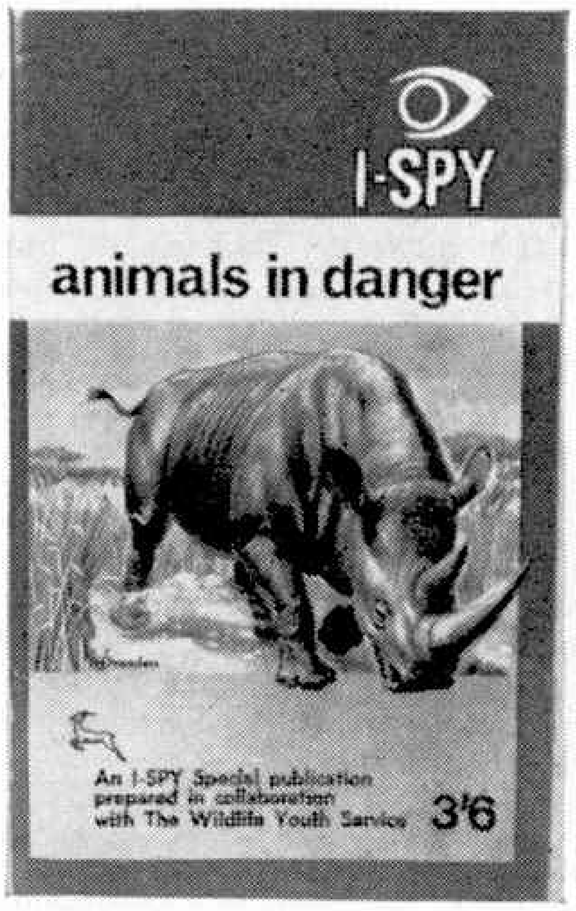


" I-Spy — Animals in Danger " Published by The Dickens Press. Price 3/6d.

Every year hundreds of different types of animals are killed by man. Every year their existing number gets smaller and smaller, and very soon they will be in danger of becoming extinct. The latest edition of I-Spy is entitled and is about ' Animals in Danger '. Many of the animals in danger from man are pictured in this book. They are divided into five groups, representing five different parts of the world. Each area is introduced with a map to show where the threatened animals are found, and each animal has a letter corresponding with the one on the map. The animals range from the Chinchilla, which is only 10 inches long, to the giant Blue Whale, which is 90 feet long. There is a picture of each animal, accompanied by a paragraph of facts and figures about it. The ' I-Spy ' scoring is a little different than usual. As it will be quite impossible to see all the animals, you are allowed to score by seeing the animals in films, on television, in zoos or in natural history museums. The book has 64 pages and 88 pictures.

" How to go Plastic Modelling " Published by Patrick Stephens Ltd. Price 25s.

Plastic kits are now very much part of our environment. The appeal of the hobby is very much international, as manufacturers from all over the world issue new kits every month. Purchasers range from youngsters, who may regard plastic models simply as playthings, to adults who may spend months working on just one model to turn it into an intricately detailed showpiece. How to go Plastic Modelling, by Chris Ellis, Editor of Airfix Magazine, is the first book devoted exclusively to the plastic kit construction hobby. This 176 page, 8½ in. x 5½ in. page size book caters for all plastic model enthusiasts, beginners or experts, serving as an essential and comprehensive guide to this popular hobby. Ten chapters take the reader through all stages of kit construction and cover such topics as basic assembly, modelling materials, tools, brushes, painting, transfers, markings, research, display, model maintenance, and scenic settings. There are 79 photographs and seven pages of scale drawings to illustrate the numerous examples, which are included to show the theories put into practice. There are also useful appendices which give guides to manufacturers, stockists, accessories, materials, sources of research, and a selected choice of good kits. This is a specialist book which is sure to become the standard reference book for the keen plastic modeller.

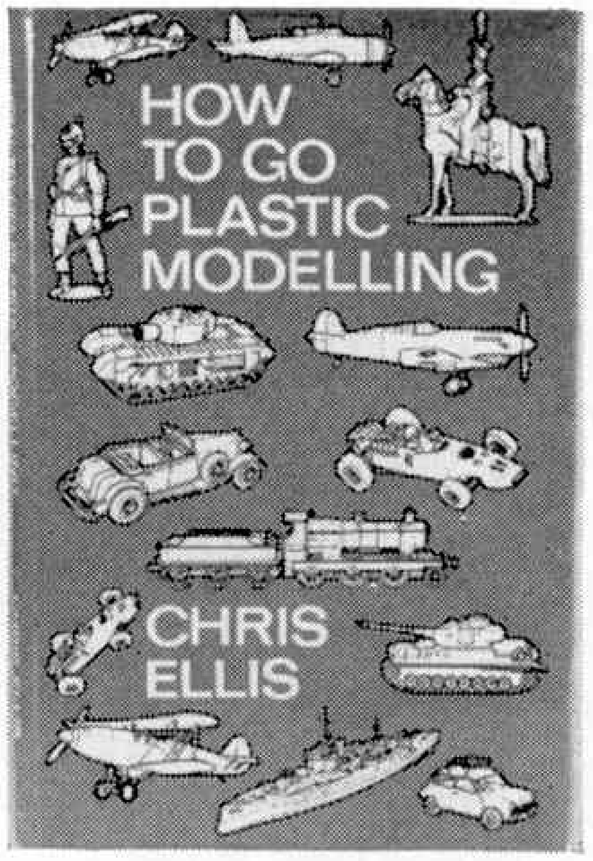


" The Book of Aircraft " Published by Macdonald and Co. Ltd. Price 15s.

From the earliest times, man has had a strong desire to fly. At first man, knowing nothing of technicalities such as power-to-weight ratios and wing loadings, tried to copy the bird by building wings, that incidentally were far too small, and, jumping off a convenient tower or cliff, tried to flap them with muscles that were far too weak. The experiment usually ended in disaster. Since that time man has advanced considerably in his conquest of flight. This 127 page book by John W. R. Taylor our " Air News " author describes the advance from the unsuccessful experiments of the bird-men, through the airships of Montgolfier and Charles, and the biplanes of the Wright's and the Voisin's, right up to the super-sonic jets and spacecraft of today. There are no less than 71 coloured illustrations on the 5½ in. x 5 in. pages. Each illustration is accompanied by details and information about the subject. ' The Book of Aircraft ' is one of a series of four books, giving a mass of detailed and fascinating factual information in its survey of aircraft. A book we thoroughly recommend for the aircraft enthusiast.

" The Caledonian Dunalastairs " Published by David & Charles Ltd. Price 50s.

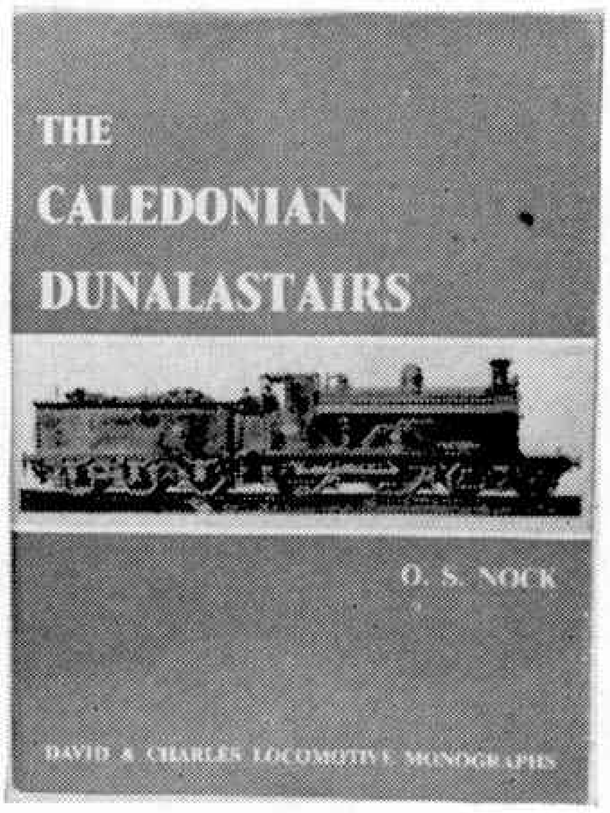
The first Dunalastair locomotive was the outcome of a modification made by John F. McIntosh on the Drummond 4-4-0 design in 1896. He introduced a larger boiler, which enabled the Dunalastair, when fully loaded, to maintain the high speeds that it had achieved as a Drummond in the ' Race to the North ' in 1895. The 139 pages of this 7½ x 10 in. page size book by O. S. Nock traces the history of the Dunalastair's design, construction and performance, with the aid of many official drawings, test results, and the diaries and recollections of men who drove, fired and maintained them.

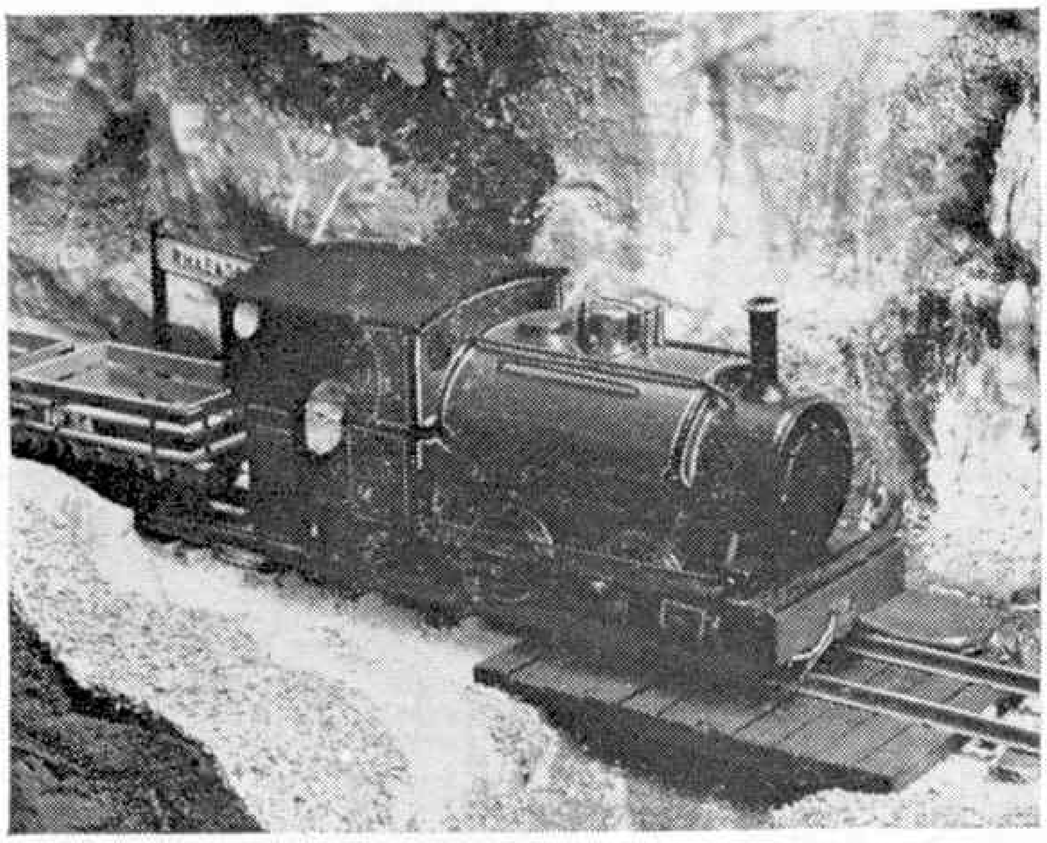


The story is traced through to the last of the Caledonian line, the ' Pickersgill Bogies ', which though not strictly ' Dunalastairs' were derived directly from them. To begin with the book gives a brief description of the Drummond, its design and subsequent modification, and then goes onto the Dunalastair. Six useful appendices are published at the back of the book containing such information as: Caledonian 4-4-0 dimensions, a note on the ' Gourock Flyers ', ' Dunalastair ' chronology, etc.

" Cover Collecting " Published by Philatelic Publishers Ltd. Price 6s.

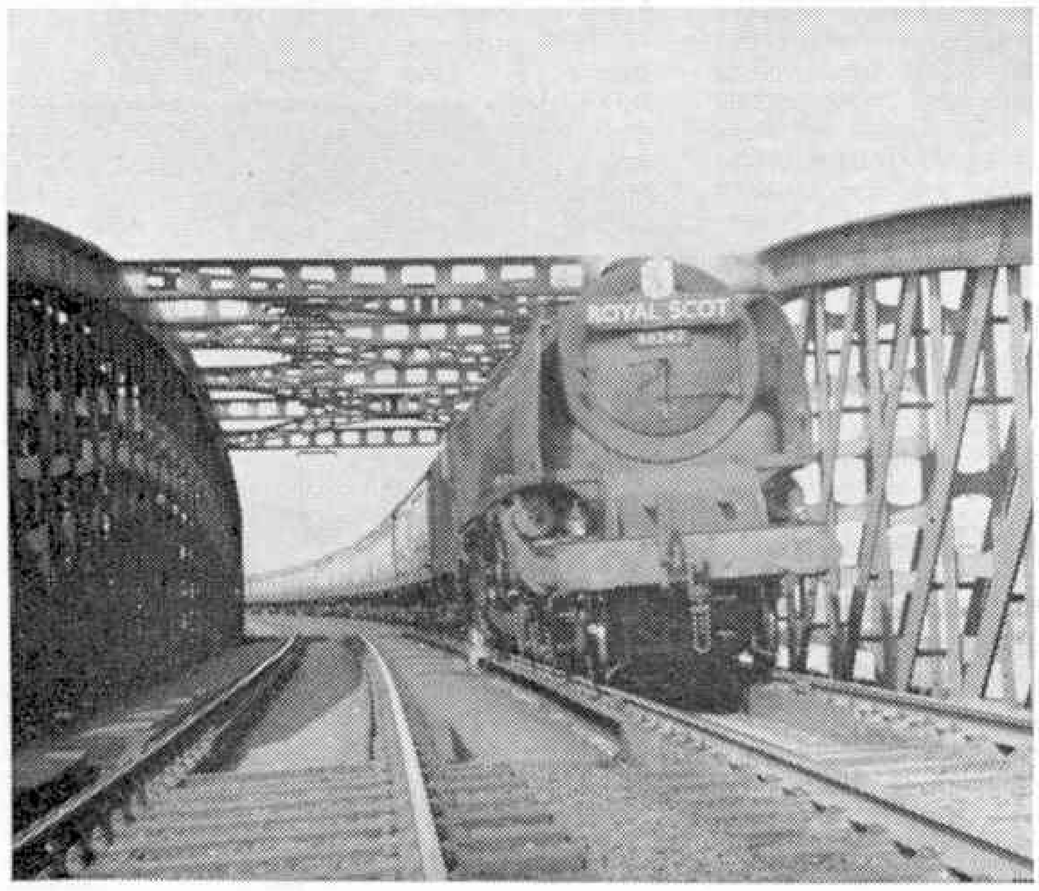
If you are a stamp collecting enthusiast, then " Cover Collecting " by James A. Mackay our stamp author is the ideal book for you to read. This book with 20 different drawings and photographs, introduces you to one of the most fascinating and romantic hobbies. It deals with a wide variety of covers, such as Military and Naval, Air, Road, Rail and Sea covers as well as First Day and other souvenir covers. It begins by describing the history of postal services, postmarks, stamps and envelopes. From then on it describes individually, the many different types of covers available. " Cover Collecting " is a paperback, has 77 pages measuring 4½ in. x 7½ in., each one full of fascinating facts, figures and illustrations. Costing only 6 shillings, it is a very worth while book to read.





Simplicity in bridge building! A simple narrow-gauge structure on John Kimber's layout. The bridge decking is built of old sleepers, and there are no handrails. Rails are simply spiked straight on to the wooden deck. Bridges like this were only used to span small streams and gullies—something more ambitious would be needed for a river !

Above: "The Thames-Clyde Express", hauled by Jubilee Class 4-6-0 No. 45589 "Gwalior" passes over the famous Trent bridges south of Trent station. Redhill Old Tunnel is in the background.



"The Royal Scot" passes over the massive bridge over the River Mersey at Warrington. Locomotive is No. 46247 "City of Liverpool". Notice the absence of conventional transverse sleepers and ballast; the rails are laid on longitudinal sleepers, and there are check-rails to minimise the effects of a derailment.

ABC OF MODEL RAILWAYS

BRIDGES

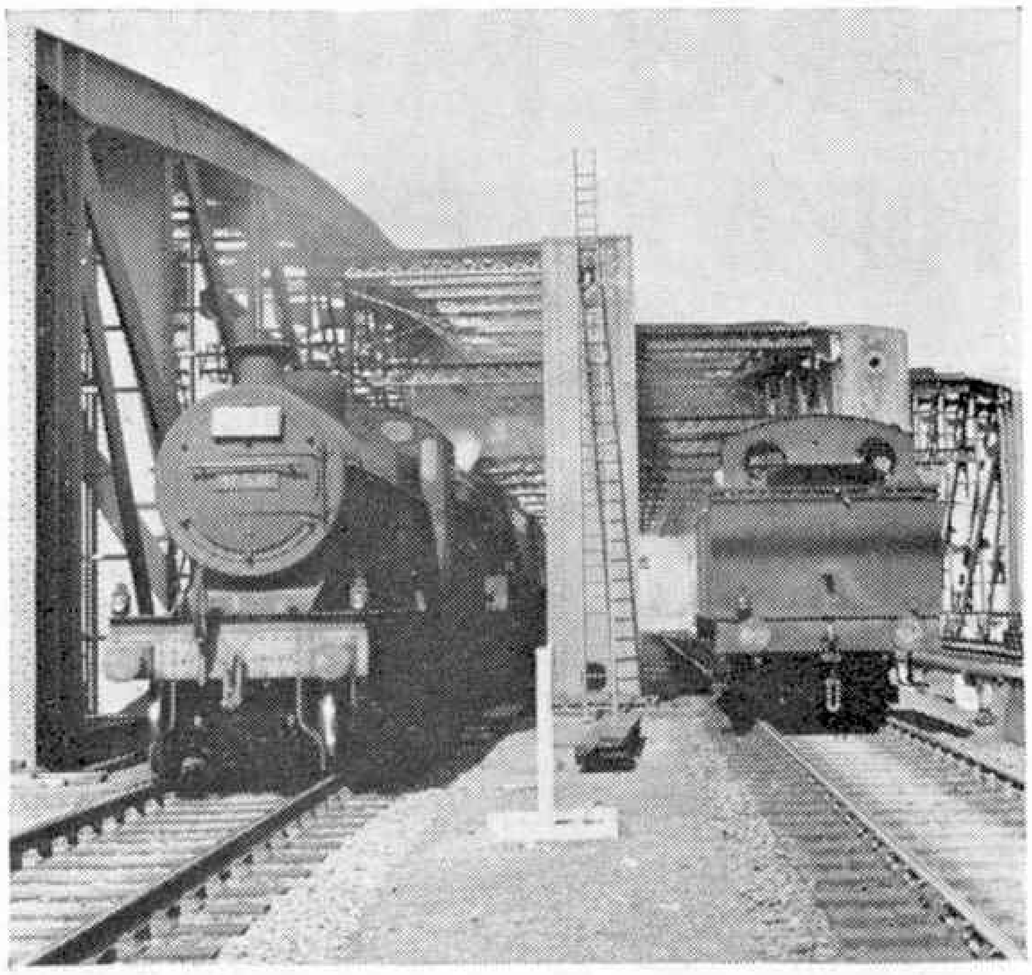
IN A recent article, we discussed the function of railway bridges and described some of the early timber bridges used by Isambard Kingdom Brunel on the railways in the west country in the nineteenth century. In this article, we are going to take a look at some more modern bridges, particularly with a view to their use in model form.

Basically, there are two kinds of bridge which are built and maintained by railways: *overline* bridges, and *underline* bridges. Both these terms are self-explanatory; overline bridges carry a road (or another line) *over* the railway, and underline bridges enable a road to pass *under* the line. The latter are not so common on model railways as the former, as track is usually laid flat on the baseboard, and the provision of an underline bridge is therefore impossible without "digging" a hole in the baseboard itself! It is usually far easier to put the road on a raised embankment and to carry it over the line by an overline bridge, rather than to put the railway on the embankment and do the reverse; this is because a model road can have much steeper gradients than a railway (this also applies, of course, to the prototype).

By far the greater number of small bridges of the types described above are of brick construction, and one of the photographs shows a magnificent array of brick-built overline bridges at Fullerton, on the S.R. Andover-Bournemouth line. This would make a most appealing model, and proves that one does not even need to have tracks running between every arch! An even simpler bridge is shown in the photograph of the narrow-gauge engine, which was taken on John Kimber's narrow-gauge layout at the 1968 Model Railway Exhibition in London. This particular bridge is the underline type, and carries the narrow-gauge tracks over a narrow stream. Because of the short span, and the extreme lightness of the tiny trains which pass over it, the bridge is of very simple construction: simply two steel girders spanning from bank to bank, and "decked" with old sleepers, with the rails spiked directly to them. Some narrow-gauge lines even dispensed with such decking, and the rails ran merely on top of the girders. Passengers, on looking out of the train on a bridge could see no evidence of the bridge itself at all—a dizzy experience.

From a small and primitive bridge, let's turn to the big ones. Most readers will be familiar with the great bridge over the Firth of Forth in Scotland, and the Tay railway bridge which replaced the one which blew down in a gale in 1879—we will tell that story in detail one day—so we have not illustrated them in this article. Rather, we have included pictures of some impressive, but not so famous (or notorious) structures, like the magnificent and complex girder bridge over the Mersey at Warrington

Right: An interesting and massive bridge, carrying several tracks over a wide river. The very conspicuous rivets should be included, if possible, in a model.



and the Trent bridges, on which the main girders rest on masonry piers. The huge girder bridge over the approach to Paddington station is a famous Great Western landmark. Girder bridges are quite complicated things to make in OO gauge, if you build them completely from scratch. We have seen some quite good ones built of balsa strip, but somehow wood never looks *quite* like metal. Tri-ang produce a very realistic bridge in moulded plastic—so good, in fact, that it is hardly worth making your own unless you particularly want to, or you want an accurate model of some particular structure.

Model bridges, like all models, are a compromise, and have to be modified in their dimensions to suit a layout. A reasonably sized river, if represented to scale, might well turn out to be over a yard wide in OO gauge, and many people's layouts are no wider than that! It is best, therefore, to resist the temptation of building a model of the Forth bridge, and choose something more modest, which will look much more realistic in the long run. If you really want big bridges, and plenty of them, then N gauge is really the size for you. Lone Star do a very nice girder bridge in this scale, made of cast metal; the girder sides clip in place on to the brick "abutments". Tunnels and bridges abound on this layout, which measures only three feet by two, which just shows what can be done in the sub-miniature scales.

When modelling bridges, it is very important to see that your track looks right where it passes over the bridge. On the old-style brick-built structures, the track was usually quite normal and laid in ballast in the usual way. Steel bridges, however, usually have a timber decking over which the maintenance men can walk, and the rails are often laid on longitudinal timber baulks instead of the usual transverse sleepers. Sometimes the wooden decking is laid between the rails as well as at either side, giving the track itself a "tramway" appearance.

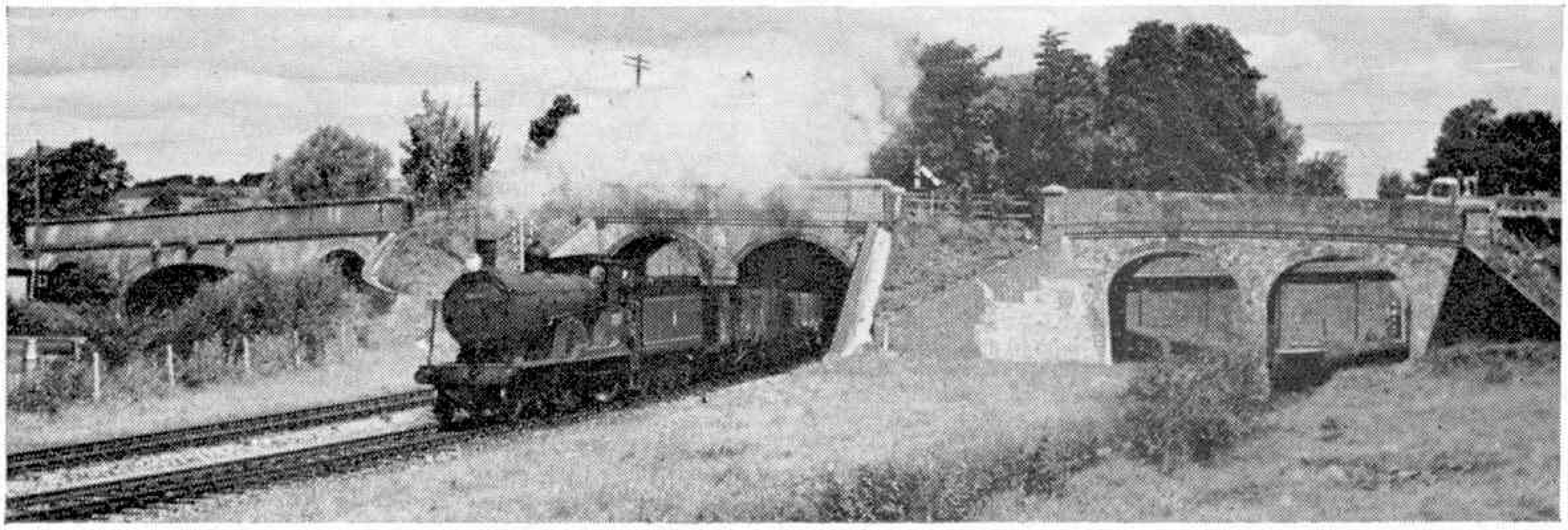
One of the problems with model bridges is that they have to cross over something; that "something" is usually a river, and water is very difficult to model effectively. Some people have even tried using real water, in metal trays, but somehow this never looks right—water refuses to be "scaled down". One of the best ways of simulating water seems to be the simplest. Paint the baseboard a dark greenish-brown (water is very seldom blue) and cover the paint with several layers of shiny varnish. Do not be tempted to try to represent rough water, with crinkled cellophane—this seldom looks like anything except crinkled cellophane!

Perhaps the best way of getting round the water problem is not to use a river at all, but make your railway cross a road instead. If any readers have their own ways of representing water in model form, though, we would be very interested to hear from them. We would also like to hear from anyone with unusual bridge models, or bridge-building techniques. Meccano is very useful for building girder bridges "on the quick" and, being metal, produces a realistic metallic "roar" when the train passes over. Appearance is quite realistic, too, if you can stand all those holes!

Talking of "roar" when trains pass over bridges, this can be quite easily achieved by laying your track on some resonant material, like Formica. Remember, though, that brick-built bridges are usually silent.

A final word for those who wish to design their own bridges for suitable locations on their layouts. Try to copy an existing bridge, at least in all its essential details. We see all too often on model railways, bridges which would give a real civil engineer nightmares; bridges which would certainly fall down when the first train passed over them, if not before.

Below: At Fullerton, on the Southern Railway's Andover to Bournemouth line, could be seen this impressive array of traditional brick-built "overbridges". The locomotive emerging is an ex L.S.W.R. T9 Class.



SPRAY PAINTING FOR A SUPER FINISH

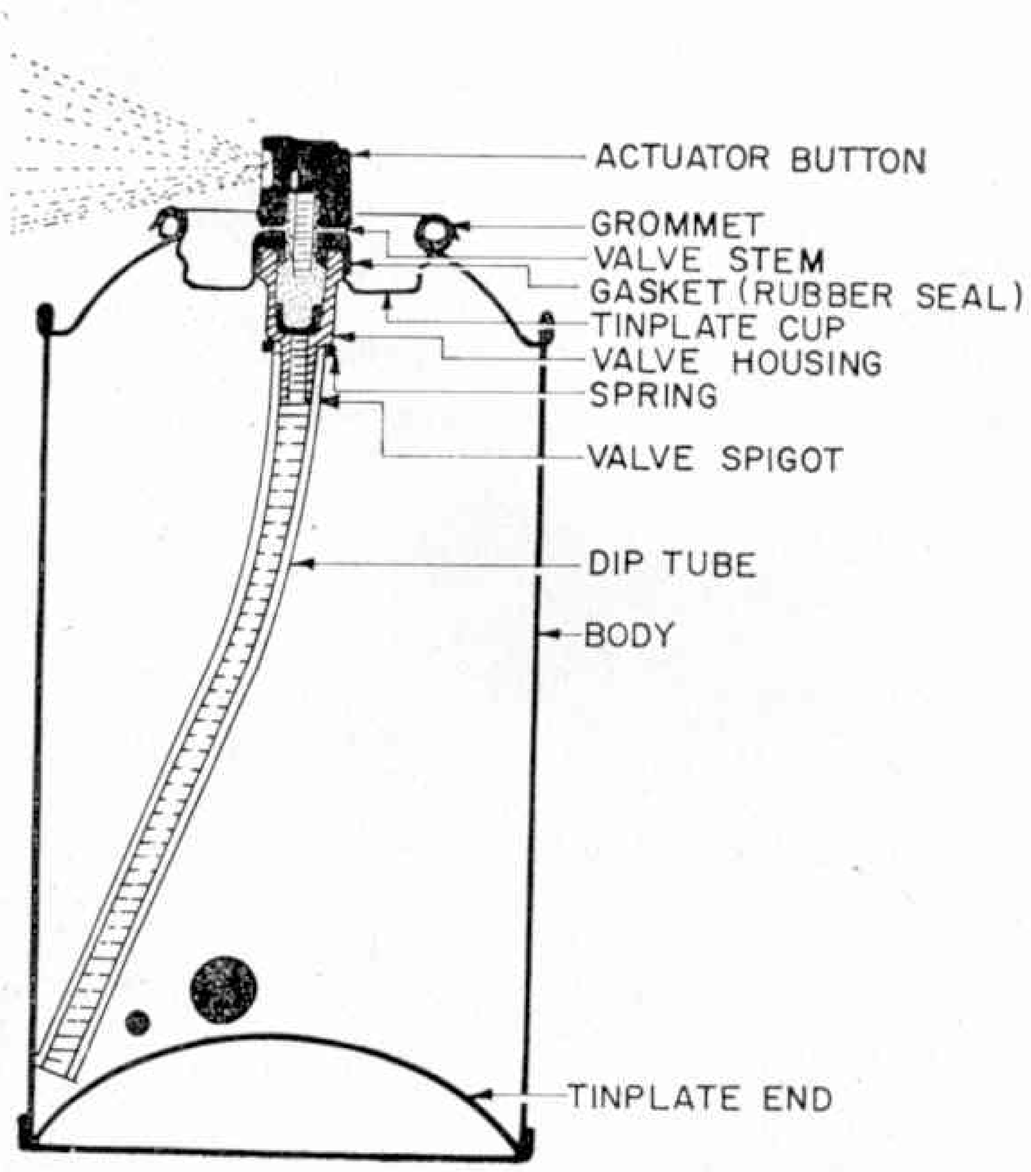
by S. SHARP, B.Sc., F.R.I.C.
Technical Director, Humbrol Ltd.

PAINTING A model which has been carefully built up, delights some people—and terrifies others! The lucky ones seem to obtain a beautiful finish every time, whilst others end up with a dusty, brushmarked surface which completely spoils the appearance of the model and does nothing to improve the builder's temper either!

Nowadays there is a method available to make these painting jobs easier. The Aerosol container has been brought into service for the modeller and Humbrol Limited of Hull, who are already known the world over for their brushing enamels, have put onto the market their own special spray enamel.

The Aerosol Principle

The principle of the Aerosol Can is quite easy to understand and the drawing shows a typical design. Briefly, the fluid (in this case, an enamel made up of pigments, resins and solvents), is contained, together with a propellant liquid, in a special can under pressure. When the valve at the top of the can is opened, by depressing the spray head, a very fine jet of enamel is forced out of the small orifice, and this can be directed with great accuracy upon the object you wish to paint. In order to aid agitation, two loose balls are placed inside the can. There are many special clever features incorporated in the 4 oz. Aerosol cans used by Humbrol; for example, the design of the actual spray head plays a big part in determining the ease and efficiency with which the spray can be applied. After much research a special spray head was found, giving a very much softer spray at a lower discharge rate than many aerosols. This enables very fine spraying to be carried out and helps to achieve the high quality finish which a carefully built model deserves. The soft spray is produced through a tiny, almost microscopic orifice on a " break up button ", which helps to make the spray even finer than in an ordinary aerosol. Furthermore, extreme care is taken with the preparation of the pigment, which is ground by a special machine to a degree of fineness not usually achieved in paint manufacture. The Aerosol is capable of giving a very beautiful finish to your models, if a little care is taken to make the best use of it.



How to use it

Anyone can use an Aerosol—but then anyone can use a paint brush—or can they?

Like any other precision tool (and after all that is what an Aerosol spray really is!) a little extra care can produce really first class results. Before you start spraying, however, it is as well to spend a little time preparing the surface if you want the best professional results. The surface which you wish to spray must first be cleaned thoroughly and all traces of grease, dirt or moisture should be removed. Humbrol enamel thinners can be used to do this. The next thing to do is to read the instructions on the can! You would be amazed how few people ever read instructions properly! On the top of the can is printed " SHAKE WELL BEFORE USE "—and you *must* do this. This is to ensure that the enamel is properly mixed and that the tube through which it is forced is completely clear. After you have shaken the tin *for about a minute*, you are ready to spray. You will already have made sure that the parts of your model which are not to be sprayed have been suitably masked off, but before you first use the Aerosol, it is a good plan to try it out on a piece of card, or something similar, so that you can get the feel of it. The technique soon becomes apparent, but there are two points which will help you. Firstly, *always depress the sprayhead fully*—this will stop any tendency towards spluttering of the enamel as it issues from the nozzle. You *cannot* control the spray pressure by varying the pressure on the sprayhead, so *don't* try it! Secondly, the spraying distance needs only to be about six inches with the Humbrol 4 oz. Aerosols. This is because the spray is not as fierce as with some Aerosols, thanks to the special spray head. With a gentle stroking action, spray across the section being painted, starting and finishing each movement *beyond* the area you wish to cover. Several light coats will enable you to prevent sagging and you will still find this economical with the special spray head. Try to maintain a steady rhythm as you move across the area being sprayed and do not pause whilst doing this, or the enamel will run. As in all modelling work, patience and a little care will produce the finest finish. The enamel made by Humbrol is based on a high grade alkyd resin, giving a brilliant gloss finish, with good durability. Careful formulation enables it to dry rapidly, without sacrificing other desirable properties.

After use

Upon completion of spraying, turn the Aerosol upside down and spray until no enamel comes out. This is in order to clear the internal tube and valve, so that the

passage may be clear for future use. The Humbrol design of Aerosol minimises the chance of the tube getting blocked, but it is still necessary to clear it after completion of each spraying operation, by inverting and spraying.

If necessary, the spray head can be easily removed for cleaning purposes. The slot at the base of the spray head can be cleaned when the head is removed, either by the use of Humbrol thinners or a piece of fine wire. In fact, you can clean it out with your finger nail, but do not exert too much pressure. Never try to clean the orifice itself with a wire or any tool. If you do this, the aperture size will be altered and the aerosol made useless for good quality painting. When replacing the spray head, hold your finger over the aperture to prevent inadvertent spraying.

Range of Aerosols

Humbrol make a most comprehensive range which will cover all your modelling needs. In addition to the eighteen colours from the standard range, there are twelve special colours, including several metallic finishes, for the car model enthusiast. There are also Aerosols containing clear polyurethane, either in gloss or satin finish. This is ideal for affording protection against water and fuels and is just the thing to give a final protective coat to your models. Particularly attractive to the model maker will be the fact that all Humbrol Aerosol Enamels are suitable for polystyrene, unlike normal spray paints. Following Humbrol tradition in brush enamels, their spray enamels are also non-poisonous, making them eminently suitable for children's toys or any household use.

Other very useful Aerosol products for modellers are the penetrating and lubricating oils. With the penetrating oil Aerosol, a thin plastic tube is provided to fix into the nozzle to allow very great accuracy and economy to be achieved in its use.

Take care

One or two points must be borne in mind with Aerosols. They should not be stored in hot sunlight or any temperature above 110°F (40°C), because if the liquid propellent gasifies due to an excessive temperature, the can may burst. Therefore the can must *NEVER* be thrown on to a fire. It should not be used near a naked flame, nor in a confined space—and obviously the can must *never* be punctured.

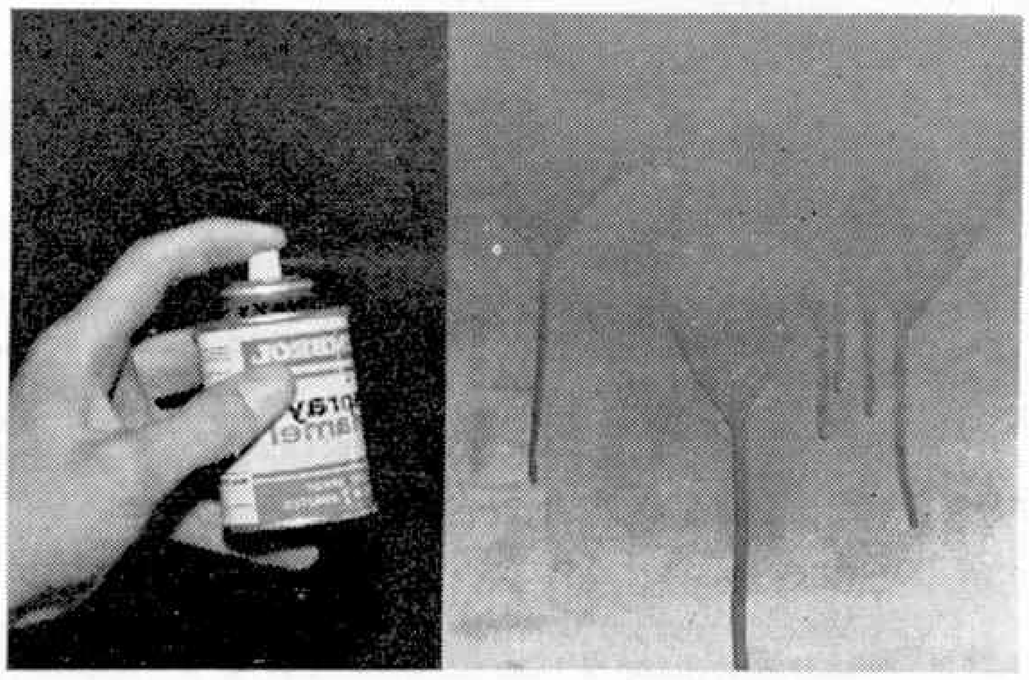
To summarise: when using Aerosols

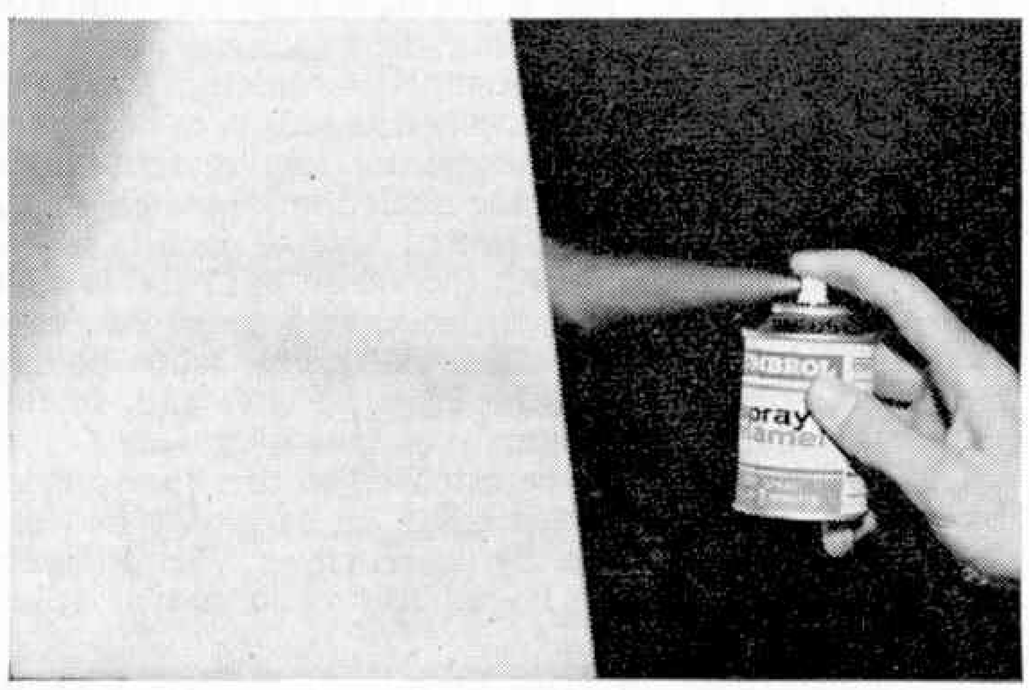
(a) Clean surface to be sprayed
(b) Shake well before use
(c) Use several light coats—spraying distance 6 in.
(d) After use, invert tin and spray until clear of enamel
(e) Clean spray head with thinners or wire, if required

DON'T

(a) Puncture the tin
(b) Throw the can on the fire
(c) Use near a naked flame
(d) Use in a confined space
(e) Store in strong sunlight or above 110°F (40°C)

Modelling is becoming easier day by day, thanks to continuous research and development by manufacturers. Aerosols will help you to obtain even better results than in the past, if properly used. Try them, and see for yourself—and happy modelling.

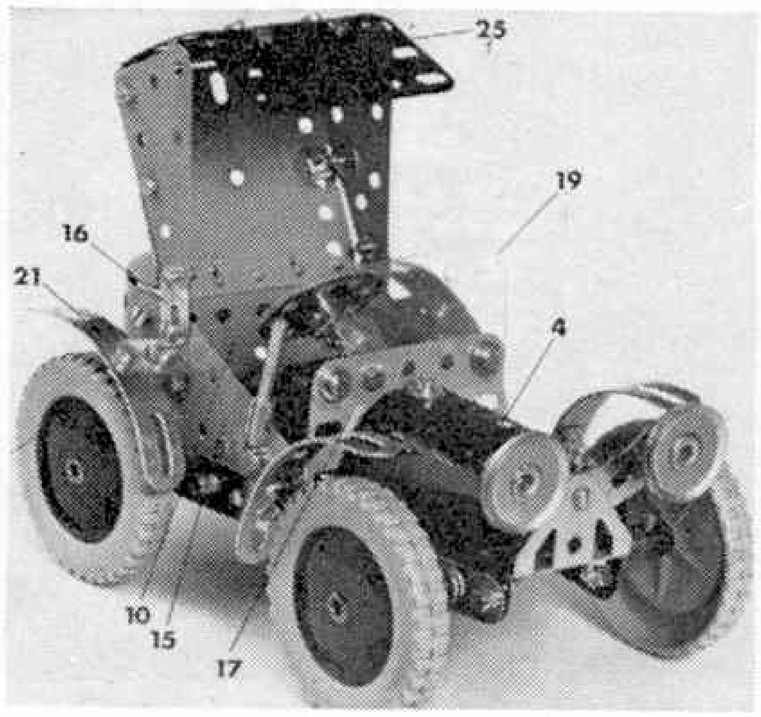




At right, top to bottom: When using an aerosol be sure to press the actuator button right down. Next, how not to use an aerosol. The paint should never run like this. Next, the correct way to spray, holding the aerosol about 6 in. from the subject being painted, and continually moving the aerosol. Lastly, a thing one must never do. Under no circumstances should a pin be used to clear the jet in the actuator. If necessary the spray head can be easily removed for cleaning purposes.

"THE 1911 NADGER"

A doctor's fictitious coupé designed and built from a No. 4 set by B. Turpin



I HAD just been reading Anthony Bird's very absorbing book 'Early Motor Cars', and admiring the fine colour illustrations, so when my small son asked me to make him 'something that isn't in the model book' the choice of subject was very easy. My '1911 Nadger', as I christened my creation, is not based on any particular car, but is fairly typical of a two-seater 'Doctor's Coupé' of that time, and it looks very authentic in yellow and black Meccano.

Construction falls conveniently into three main sections: the chassis and bonnet, the cab and boot and the hood.

The chassis and bonnet

Dealing first with the chassis, this basically consists of a Flanged Sector Plate 1 to which a Trunnion 2 is fixed to act as the radiator. A $2\frac{1}{2}$ in. Stepped Curved Strip 3, later holding the headlights, is bolted to the Trunnion then the bonnet is built up from two $2\frac{1}{2} \times 2\frac{1}{2}$ Black Plastic Plates 4, joined at their slotted edges. The shape is achieved by joining them at a slight angle, so that while the slotted holes match at one end, at the other end the slotted hole of each is bolted to the first round hole of the other. (There is only one such position.) In acordance with usual Meccano practice, I like to use Washers if possible when bolting through slotted holes in the Plastic Plates and, in this case, they add to the design.

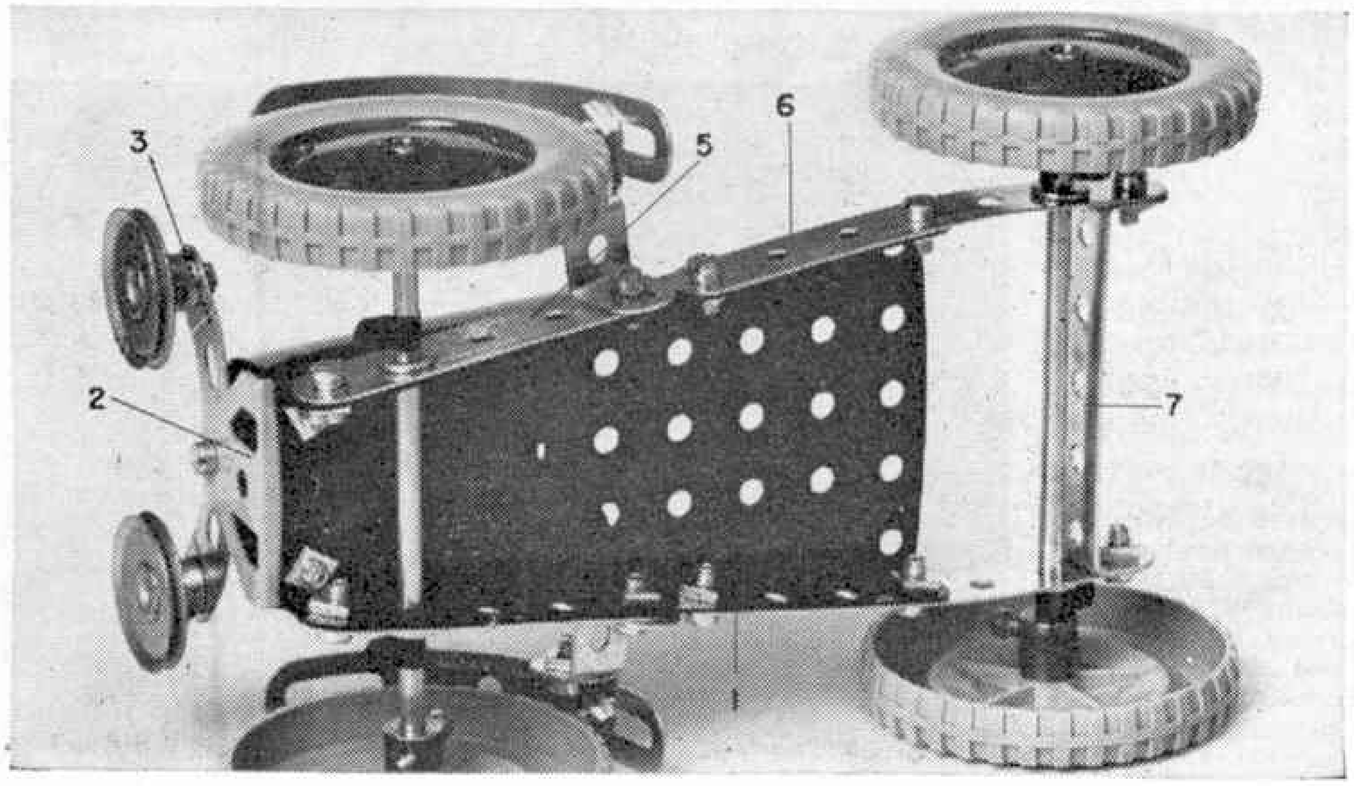
The bonnet can now be attached to the Sector Plate by sandwiching the slotted edges on each side between the Sector Plate and a $2\frac{1}{2}$ in. Strip 5. Immediately behind the Strips 5 are bolted two $3\frac{1}{2}$ in. Strips 6, extending the chassis, and these are joined at the far ends by a $2\frac{1}{2}$ in. Double Angle Strip 7 reversed so that the free ends look like the ends of vehicle springs.

Two 4 in. Rods serve as axles. Because of the shape of the chassis they will need to be held centrally by Spring Clips, which in turn are kept away from the chassis by Washers to ensure smooth rotation of the axles. The Road Wheels can now be attached, though it will be found later that their exact positions on the Rods may need adjusting a little to match well with the mudguards. Two 1 in. Pulleys with Boss are fixed to Curved Strip 3 to complete the chassis section by serving as headlights, the Pulleys being held by their Grub Screws on Bolts pushed through the Curved Strip.

The driver's cab

The cab section can be built as a completely separate unit, and joined to the chassis afterwards with only two Bolts. A seat is provided by a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flanged Plate 8 to the underside of which a Trunnion 9 is fixed to support the backrest, which is a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 10. Before going any further, however, the boot is made up from a $5\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 11, curved and held in shape by two Double Angle Strips 12 and 13 bolted through the last round hole on each side at top and bottom. Acting as the boot lid is a Semi-circular Plate 14 bolted to Double Angle Strip 12, with an Angle Bracket to secure it at the middle of the curve.

Having made up the boot in this way, it can now be bolted to the side flanges of the seat at the same time as two $2\frac{1}{2} \times 1\frac{1}{2}$ in. Triangular Flexible Plates 15 which form the cab sides. The Triangular Flexible Plates are each bolted through two holes in the side flanges of Flanged Plate 8, the second fixing of the boot being made to the top corner of each Triangular Plate, at the same time securing in place, two Fishplates 16 which will later support the hood. At the front, the Triangular Plates are joined by a $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip to which a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 17 is bolted, the securing Bolts also holding two Angle Brackets 18 which will later be used to join the cab to the chassis.

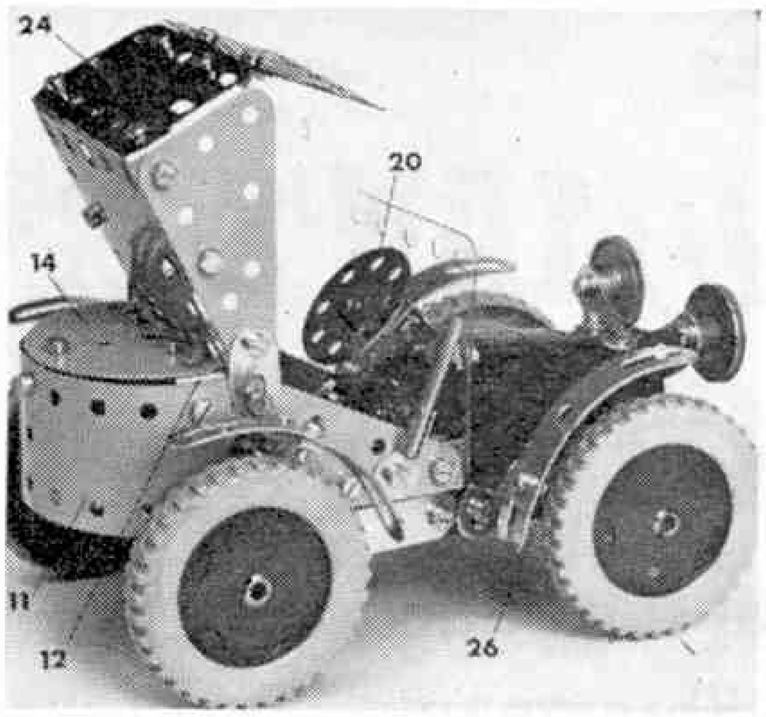


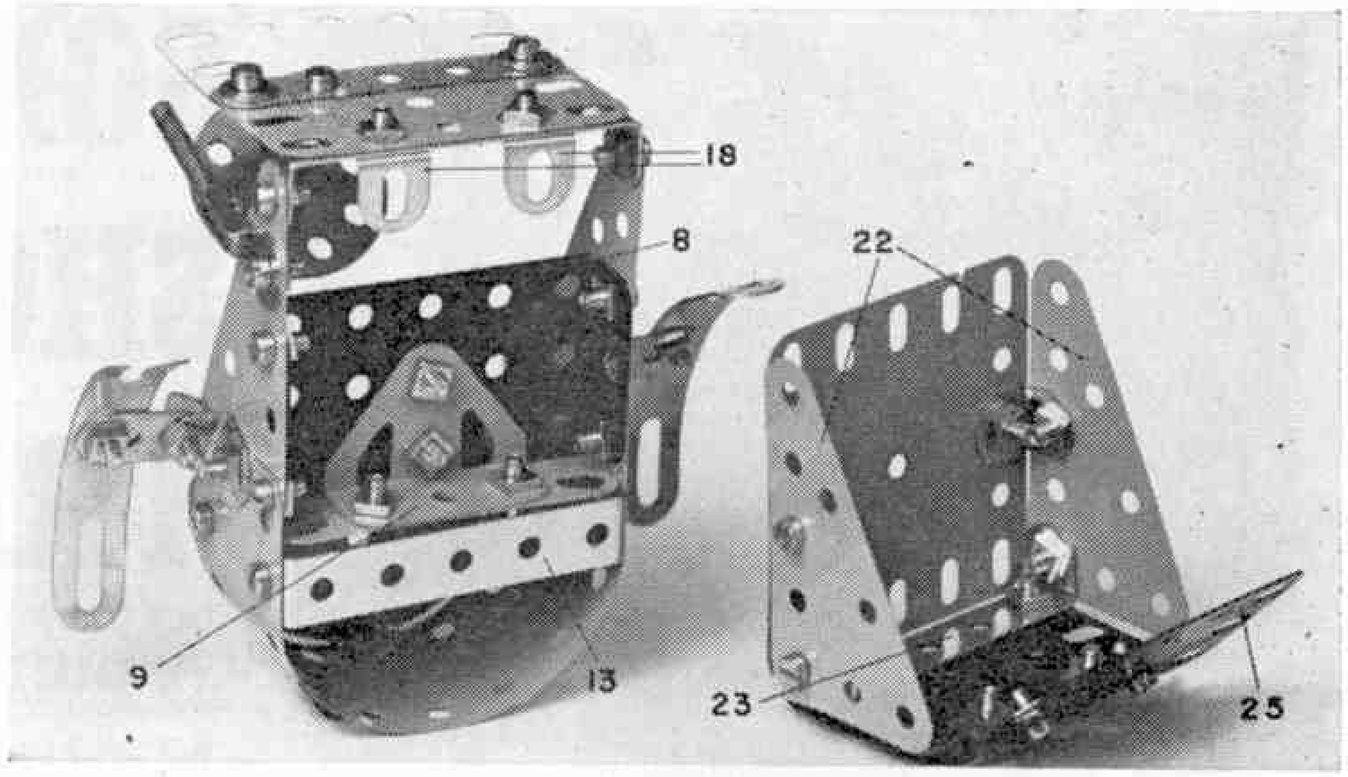
Above: Christened "The 1911 Nadger" by its designer Brian Turpin of Stanford-le-Hope, Essex, this delightful little model is based on a doctor's coupé of a type in use early this century.

At left: An underside view of the chassis as it appears before the cab and hood are added.

Opposite: Another general view of Brian Turpin's "1911 Nadger" coupé, built with Meccano Outfit No. 4.

Opposite: Close-up views of the cab and hood sections, built, but removed from the model to assist description.





A windscreen is supplied by a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Transparent Plastic Plate 19 and, once again, Washers have been used when bolting through the slotted holes. The steering-wheel, an 8-hole Bush Wheel 20, is fixed by means of a bracket made up from an Angle Bracket and an Obtuse Angle Bracket bolted together. Note that it is the Obtuse Angle Bracket which is screwed to the cab front, otherwise the steering wheel will end up in too low a position. The Bush Wheel, itself, is fixed by its Grub Screw to a $\frac{3}{8}$ in. Bolt pushed through the Angle Bracket.

Each rear mudguard is represented by a Formed Slotted Strip 21 attached to the cab by means of an Angle Bracket the upper lug of which is extended by a Fishplate. The exact positioning of the mudguards will take a little juggling to agree with the wheels after the cab is fitted, so it is not worth tightening the Bolts too firmly at this stage. The cab is completed by fixing the handbrake to the cab side, the brake consisting of a $1\frac{1}{2}$ in. Rod in a Rod and Strip Connector, then the cab is fixed to the chassis by means of Angle Brackets 18.

The hood

We come now to the final section of the model, i.e., the hood. Two $2\frac{1}{2} \times 1\frac{1}{2}$ in. Triangular Flexible Plates 22 are joined together by a $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip 23, to which a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Black Plastic Plate 24 is bolted. A second $2\frac{1}{2} \times 1\frac{1}{2}$ in. Black Plastic Plate 25 is attached to the first by means of two Obtuse Angle Brackets, then the back of the hood is completed by a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate joined to Triangular Flexible Plates 22 by means of an Angle Bracket at each side. The finished hood can now be attached to Fishplates 16, previously provided on the cab. For the best effect, it should lean back slightly.

Front mudguards

This leaves us with the front mudguards which have been kept till last because their adjustment is critical, and can be disturbed if fitted earlier. Like the rear mudguards, they consist of Formed Slotted Strips 26, but this time they are joined to the chassis by brackets each made up from an Angle Bracket and a Reversed Angle Bracket, bolted together through the round hole of each, with the lower slot of the mudguard bolted to the Angle Bracket in each case. In order that the mudguards can be parallel to the wheels, the Angle Brackets will need to be opened out very slightly. The Reversed Angle Bracket is attached to the rearmost hole of Strip 5, using the Nut and Bolt previously put in to secure the bonnet. Parts of the brackets should now be swivelled to adjust the mudguards until they conform properly to the wheels, after which the securing Nuts and Bolts should be tightened to complete the model.

PARTS REQUIRED

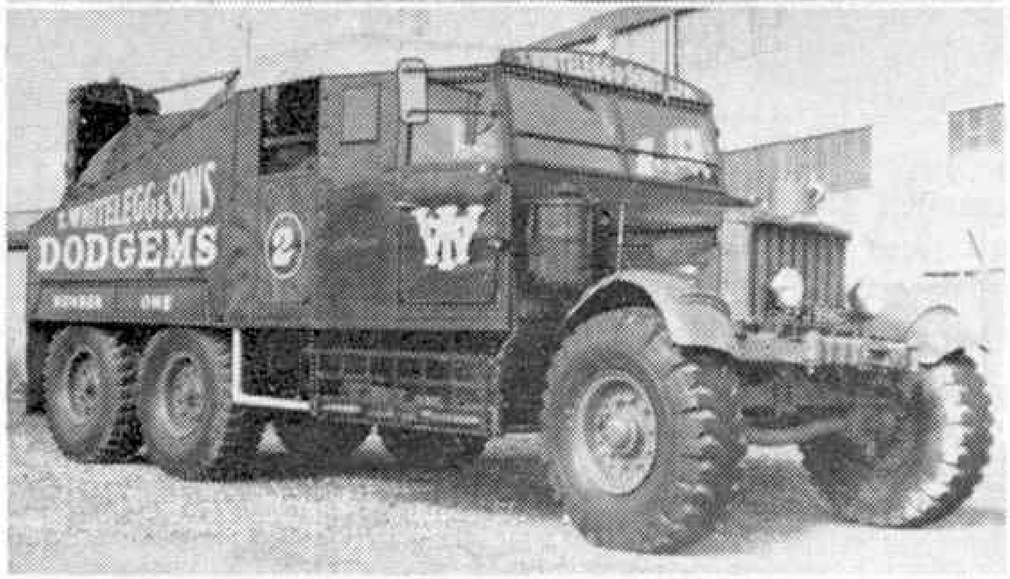
2—3	1—24	1—90a	1—193
2—5	4—35	1—111c	2—194
4—10	69—37a	2—125	2—194a
10—12	71—37b	2—126	1—212
3—12c	9—38	4—187	1—214
2—15b	5—48a	2—188	4—215
1—18a	1—51	1—189	4—221
2—22	1—54	1—190	

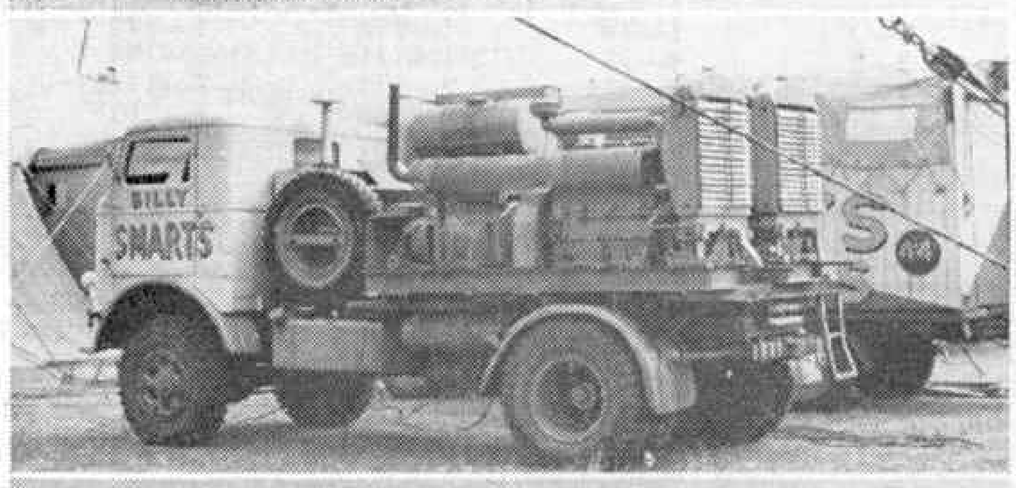
Stamps in the British Museum—
Continued

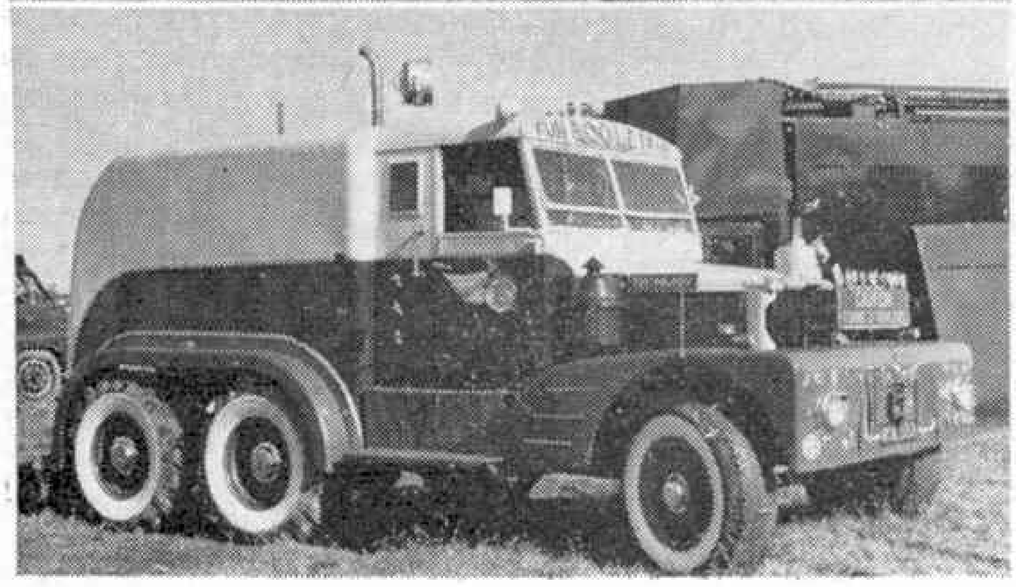
put on display and it is hoped to change it every year so that the most recent issues of the world are on show.

Since 1900, also, the Crown Agents have supplied the Museum with a copy of each stamp issued in the territories whose stamps they control. Although more than half of the sixty territories concerned have now become fully independent they have been satisfied with the excellent service given over the years by the Crown Agents that they have continued to have their stamps handled by this body. Consequently the stamps of such countries as Nigeria and Ceylon are still sent to the Museum via the Crown Agents. None of this large collection is on show, but there is a monthly exhibition of the latest issues from the Crown Agents and this includes photographs, artists' sketches and colour trials showing how a multicolour stamp is built up from as many as seven different colours.

The British Museum's stamp collections resemble an iceberg: only a small fraction is on show, the rest being stored in specially constructed strong-rooms underneath the main gallery. The other collections in the Museum's possession are too numerous to mention in detail but they range from a thirty-volume study of Railway Letter stamps and a large collection of Siamese stamps to a highly specialised collection of German local stamps produced in various towns at the end of the last war. These collections can be made available to students and research workers on application. Facilities for students are unfortunately limited but we do our best to accommodate those with a serious enquiry. Lectures on various aspects of the stamp collections are also given from time to time to school parties and philatelic societies.







SOME SHOWMAN'S TRACTORS

A pictorial introduction to the Modern Showman's Tractor

by R. M. Collis

OF the varying types of commercial vehicle, perhaps the king of them all is the heavy haulage tractor—I refer of course to the independent type for use with drawbar trailers, and not the prime-mover of the 'artic' type.

Heavy haulage tractors are mainly employed in small numbers by specialist operators, due to the exacting nature of the loads they are called upon to move. Probably the commonest form of such tractors, and certainly the most varied, are the heavy showman's tractors. Almost the whole year round showman's tractors, of one type or another, are to be seen with travelling amusements in many a town or the surrounding countryside.

The great majority of these tractors differ from their commercial and military counterparts in that they are required to perform two main functions: firstly, the haulage of the showman's various amusements and ancillary items (e.g. living wagons) upon the road; and additionally to generate electricity to drive and light these same amusements.

Showman's tractors can be split into two distinct categories—those used by travelling circuses and the others (by far the greater part) used with travelling fairs. Of the latter type, the fairground tractor, practically all are fitted with heavy-duty dynamos, used to generate for the amusements to which they are attached. These dynamos can often produce as much as 450 amps. (normally at 110 volts) and are either driven from the tractor's own engine (by means of a p.t.o.) or more usually from a separate diesel engine mounted upon the rear of the tractor. The latter arrangement is of course known as a generating (or lighting) set (these also provide

At left, top to bottom: A 4 x 4 winch/crane tractor. This is a 1943/45 Admirality tractor extensively modified. Next, a 6 x 4 tractor again ex W.D. These Scammel 6 wheel tractors are quite common in fair grounds. It is fitted with 2 generating sets and was originally a tank transporter tractor. Next, an ex W.D. 4 x 4 gun tractor. This is also fitted with 2 generating sets and many are to be seen. Next, this F.W.D. is fitted with two generating sets and has very heavy cast spoked wheels. At left, a 6 x 4 Scammel fair ground tractor that has been extensively re-built with special limousine type coachwork.

the necessary ballast over the tractor's rear axle(s)). However, not all of the circus tractors carry dynamos—but are used solely for haulage (and lifting) purposes. Those that are fitted with dynamos differ little from their fairground counterparts. (N.B.—With the really large travelling circus there is usually to be found a special generating vehicle which provides for the lighting inside the 'big-top'. A typical example would be a rigid 8-wheeler lorry carrying an abnormally large (marine) diesel-engined generating-set; the dynamo of which would also be of immense proportion. Such vehicles are now rare.)

Other details common to both fairground and circus tractors are that nearly all are equipped with engine-driven winches and a reasonable number have specially fitted cranes too. In fact, almost all showmen's tractors are ex-W.D. vehicles which are extremely tough, being built for 'off the road' conditions. Most older readers will know that such ex-W.D. vehicles offer real value for money when released upon the commercial vehicle market. Hence their use by showmen, for specialist-built showman's tractors could cost up to ten times as much as the equivalent ex-W.D. vehicle.

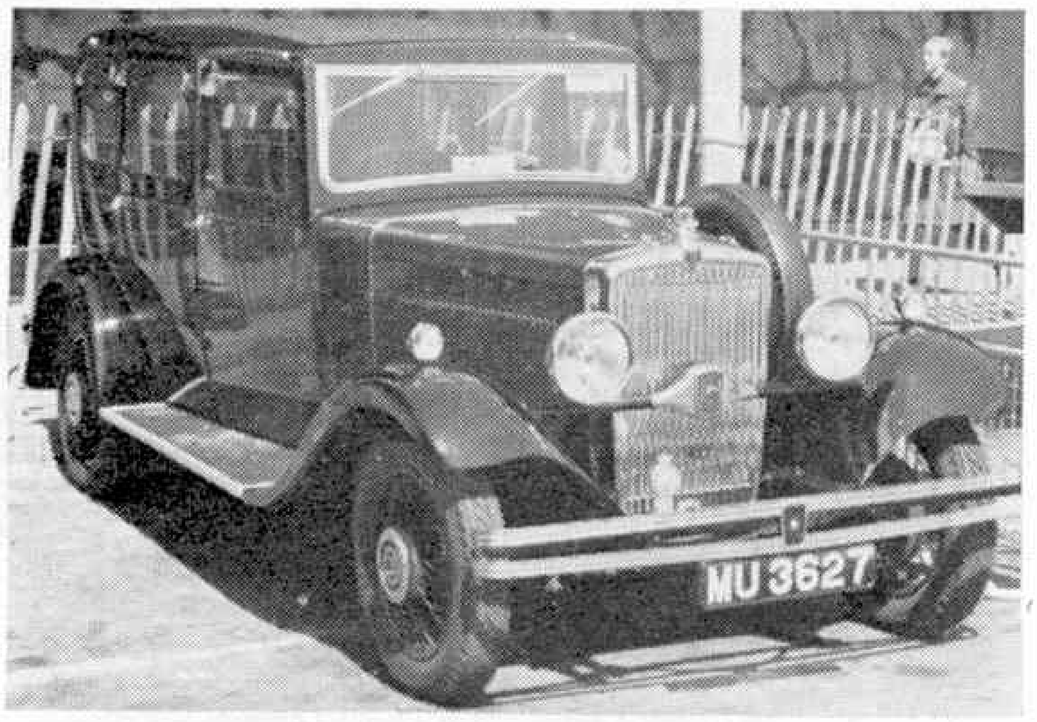
In past years a number of showman's tractors have been built new for fairground use by various leading manufacturers, but of these the only one to appear in any significant number, came from Scammell. This was the Scammell-Harrison 'Showtrac' which was built from 1946 to 1953.

These notes and the accompanying photographs are meant by way of a brief non-technical introduction of the showman's tractor to the younger element of Meccano Magazine readers. Although the writer hopes that the photographs (showing examples of both fairground and circus tractors) will be of some interest to all readers.

The showman's tractor is certainly a wonderful and most fascinating subject for Meccano modelling (and indeed for several other forms of model-making). The reader who finds such tractors of interest and has a fairly substantial Meccano Outfit, can of course, besides constructing a working model tractor, construct additional showman's trailers, of the appropriate size and type, to couple-up with the tractor. (N.B.—On the subject of showman's trailers in Britain today, the showman's tractor (which legally must not exceed $7\frac{1}{4}$ tons in weight) is restricted to the towing of 3 trailers upon the highway.)

The accompanying selection of photographs, all taken by the writer in recent times, show examples of both fairground and circus tractors of varying size and make, included among these are two specialist-built tractors.

At right, top to bottom: A pre-war 4 x 2 Foden fitted with a winch tractor and folding crane. Note the land anchor beneath the chassis. Next, a rare specimen, this being one of the few tractors specially built for fair ground use. This is a 6 x 4 Thorneycroft "Amazon". Next, again designed and built for fair ground use, this is a 4 x 2 Scammell "Show track". Next, an ex W.D. 6 x 6 "Mack" circus tractor of 1940 vintage with a heavy duty generating set. Another view of the 6 wheeled Scammell this example is named "Impregnable". Note the high standard of decoration and those extra large tread tyres for fair ground sites.



A 1932 Morris Oxford Saloon. Power was supplied by a 2½ litre side-valve engine, and brakes were hydraulic.

The Pre-War Motors

by John Brewer

ALTHOUGH THE sports and racing cars of the Veteran and Vintage eras of motoring undoubtedly have a strong appeal for car enthusiasts, the mass-produced vehicles of the nineteen-thirties also have a very important place in history, and more and more people are becoming interested in them. Around the year 1930, a big change took place in the world of motor cars. More people wanted to own cars, and the motor manufacturers had to use new techniques in order to make enough cars, at the right prices, to satisfy the growing demand. Not that mass-production was new; Henry Ford had shown, some twenty years earlier, that he could produce thousands of identical Model T cars at very low prices. In England, however, cars still tended to be hand-built and expensive, or fairly cheap but correspondingly crude. During the 'twenties, the Morris Cowley and the Austin Seven paved the way for the following decade; "Motoring for the Masses" was the motto then, and it still holds good today.

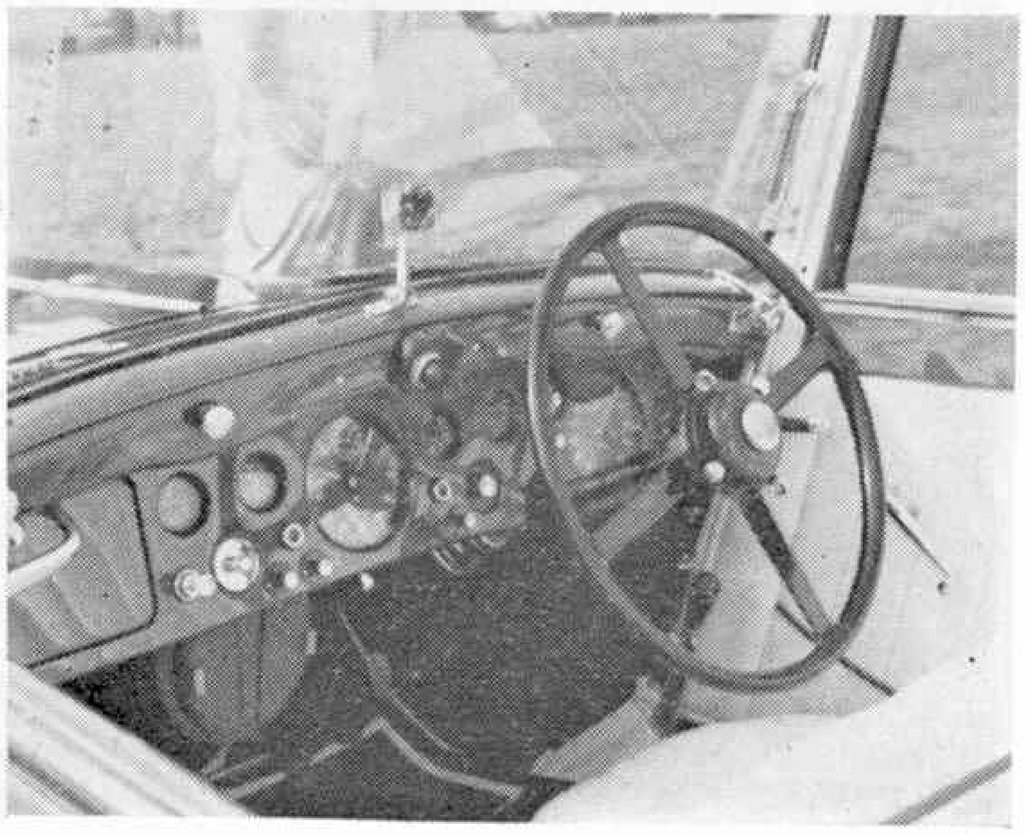
From 1930 onwards, British car manufacturers went in for mass-production in a big way. Hand-beaten panels gave way to steel pressings; mechanical design tended towards simplicity, with none of the experiment of the 'teens and 'twenties, and the market researchers and "stylists" went to town, for it was a highly competitive market. Coach-painted bodies gave way to sprayed cellulose finishes, and chromium plate ousted polished brass and nickel.

Although the average cars of the 1930's lacked the glamour and "craftsmanship" of the vehicles of the previous decades, there were many compensations. They were in general *much* easier to drive; many modern motorists would be envious of the Morris clutch of those years; the firm itself stated "A Morris owner is as aware of his clutch as a healthy man is of his liver". It was quite true. Engines in those days had very long strokes, which meant that they were more powerful (i.e. produced most *torque*) at low engine speeds. If you let in the clutch of a pre-war Morris Ten, even in *second* gear, and kept your foot off the accelerator, the car would not stall; it would simply amble away. Ideal for town driving, and almost as good as an automatic transmission! This sort of performance was achieved by an engine of only 1292 cc capacity.

Above all, the cars of the 1930's were built for *service*, in a way that no car was built before or since. Steel panels were extremely thick, and paint was laid on thick as well. Cars were made to be *practical*, and practicability came before appearance. With a modern, flush-sided car, a slight "shunt" in traffic can mean a damaged door, and an expensive repair. Most pre-war vehicles had wide running boards which, although they could be a nuisance to people getting in and out, provided a massive "bumper" along the side which protected the doors from harm. Even if you pranged a wing, it was a simple enough matter to unbolt it for replacement or repair. Headlamps were always separate fittings which could be adjusted for angle at a moments notice: not such an easy job today!

Consider the specification of a 1936 Morris 10 horse-power car. It had Lockheed hydraulic brakes (Morris had used them since 1930) with *rust proof* brake lines—none of your horrible steel ones, as used now. The driver sat behind an ammeter, oil pressure gauge, fuel gauge, speedometer and clock (none of your "extras" needed); seats were of real leather, and real carpet covered the floor. The windscreen could be opened wide (ask Dad how useful this was in foggy weather!) and a sliding roof was probably fitted as standard. If you had to change a wheel on the road, there was no messing about with a jack, and crawling on your knees. Hydraulic built-in jacks were fitted to each axle (a *standard* fitting) and these were worked from a lever inside the car. It is funny to think that the Morris owner of 1936 would have considered the ordinary car jack to be very, very old-fashioned. All this could be bought for the princely sum of £185.

We must not be too hard on the cars of 1968. What the financial wizards call the financial "climate" was quite different then to what it is today, and our Morris Ten would probably cost thousands now. These days, to keep prices down, many more vehicles have to be produced per year than were in those far-off days, and many of the old amenities (like the built-in jacking system) have had to go by the board. People's attitude towards the motor car has changed; now it is an essential but dispensable commodity, like toothpaste.



The sumptuous "cockpit" of a Bentley tourer of the middle 1930's. Note the immaculate walnut dashboard and four-spoked steering wheel.

AIR NEWS

by John W. R. Taylor

MOST PEOPLE in Britain would be surprised if they knew how often Russian bombers fly near our coasts. There is, of course, nothing to stop them doing so, unless they come too close and break international law—like a ship entering our territorial waters. Western bombers and reconnaissance aircraft are equally active around the borders of Russia, and this accounts for occasional press reports of American military aircraft being attacked or shot down when they may or may not have ventured nearer to the border than they should.

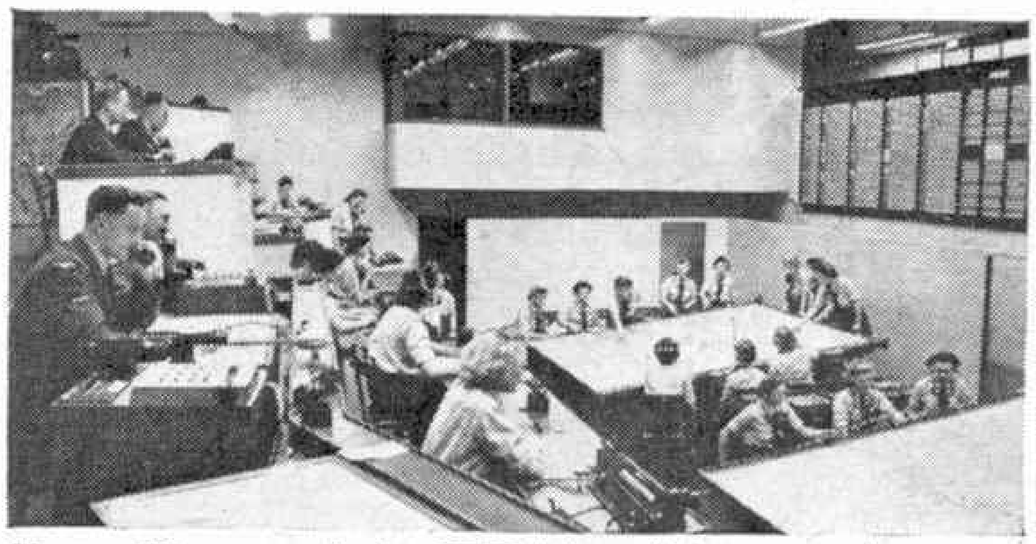
Like the Russian trawlers, festooned with aerials, that sail through the Channel, and the U.S.S. *Pueblo* that was captured by the North Koreans, these aircraft are engaged in the secret "peacetime war" of electronic reconnaissance. By "listening" to radar and radio signals from the other side of the border or coastline, their crews can learn much about the kinds of radar that are in use by the defence forces to give warning of air attack and guide anti-aircraft missiles and fighter 'planes.

Such information is of tremendous value, as the sites of radar stations can be plotted and their efficiency measured, after which it is easier to work out ways of penetrating the defences.

The fact that this goes on does not mean that a war between Russia and the West is likely. The more each side knows about the other's strength, the less likely it is that there will ever again be a major war.

Certainly the Russian Air Force can have little doubt of the efficiency of Britain's air defences, because whenever one of its snooping bombers is picked up by our radar, which operates day and night, Lightning fighters are sent up to intercept it. As well as providing quite realistic practice for pilots of R.A.F. Strike Command, this must make the Soviet aircrews glad that their mission is comparatively peaceful when they see the deadly Firestreak missiles carried by the fighters closing in to "escort" them around our coastline.

Such work has become routine for Britain's radar stations since they came into being in the late 'thirties. We all know what a tremendous contribution they made to victory in the Battle of Britain. Today, many of the radar operators perform another, equally vital service to keep us safe, and I was invited to visit the R.A.F. station at Lindholme, near Doncaster, a few weeks ago to learn about this at first hand.



Above: The scene during W.W.2 in a fighter operations room during the birth of radar. Below: A Soviet Myasivhchev Mya-4 (Bison) is escorted by two Lightning fighters.

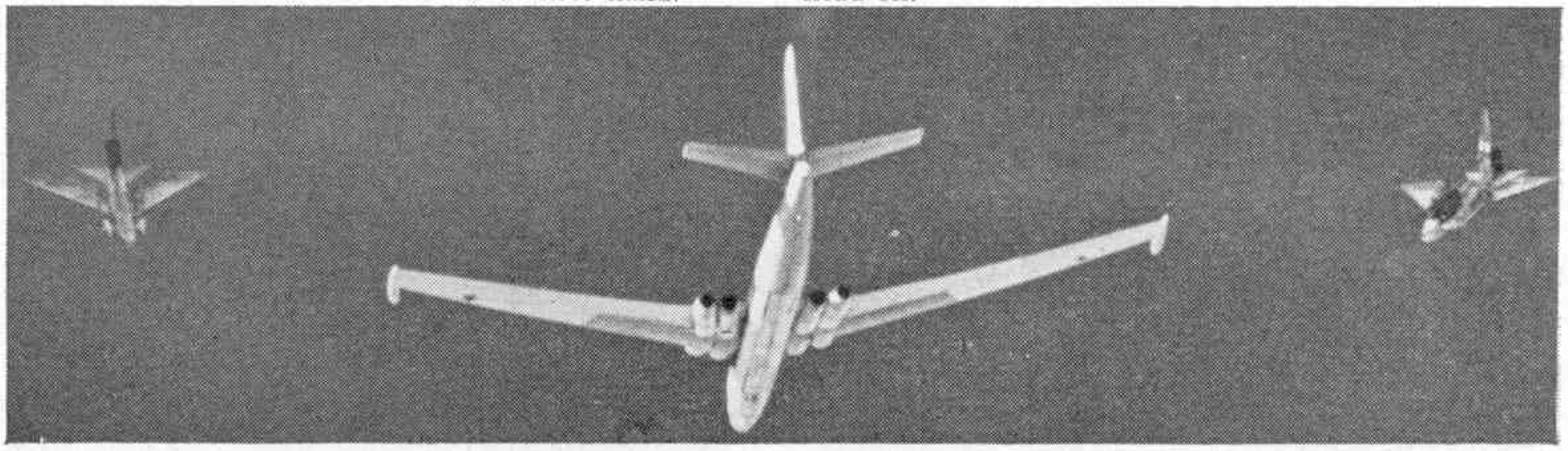
Lindholme is the home of the Northern Air Traffic Control Radar Unit, just one of seven such units in Strike Command which keep track of military aircraft flying over the U.K., and control them, as part of our National Air Traffic Control Service.

As little as ten years ago, aircraft could fly over Britain much as they pleased. Airliners could be controlled only when they flew in low-level airlanes within a short distance of airports. Military aircraft were controlled, as a rule, only when near to R.A.F. stations. The risk of collision was great, and pilots had to spend much of their time looking around for other aircraft instead of concentrating on their flying.

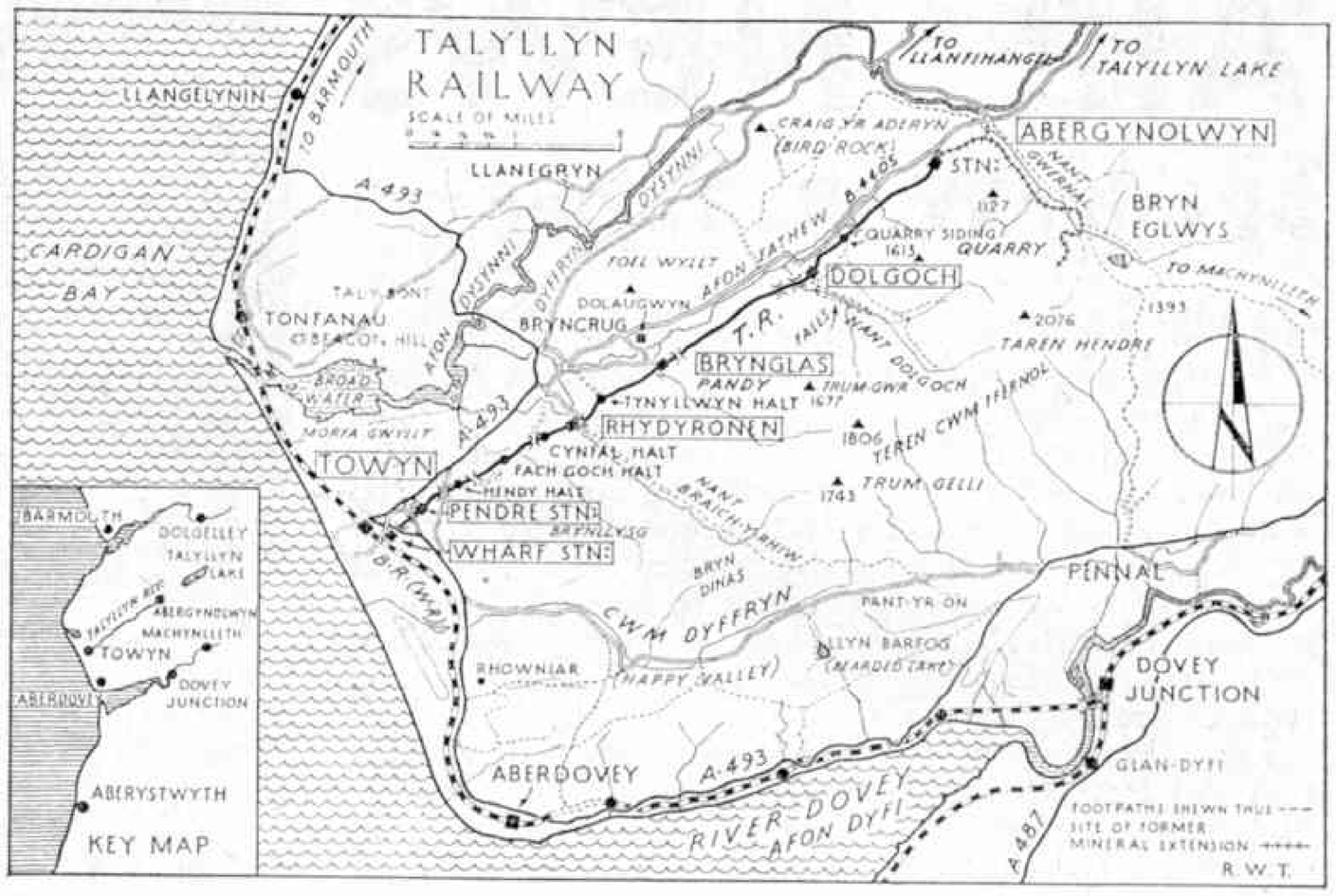
A committee was set up to suggest ways of improving this sorry state of affairs, and today Lindholme has equipment that enables it to track by radar, and control by radio instructions to the pilots, all civil and military aircraft flying above 25,000 ft. over 12,000 square miles of Northern England and the North Midlands. It ensures that the aircraft are always separated by a distance of at least five miles, or by a height of 2,000 ft. Special attention is paid to aircraft crossing the airlanes below 25,000 ft. or flying into or out of airfields. Help can be given in emergencies and, in all, more than 11,000 aircraft use its services every month.

It is difficult for anyone born in the last 20 years to imagine what flying was like in the days before radio and radar.

Pilots sat in open cockpits and usually found their way by following the roads and railways that were easily visible from the low cruising height at which they flew. One day, the pilot of an airliner bound from London to Paris had his head over the side, studying a familiar, straight French road above which he was flying. The pilot of a London-bound airliner was following the same road, at the same height, at the same time, but in the opposite direction, and also had his head over the side. The two aircraft met, head-on.



TRANSPORT TOPICS by Mike Rickett



NOT SO many weeks ago, the only form of transport available in many towns and villages in the South East was at best, a rowing boat or canoe, and at worst, a pair of good wellington boots! Roads were impassable, and many railways were put completely out of action by the extensive flooding that made many hundreds of people homeless.

Southern Region engineers recently began to count the cost of the deluge, described as the worst to hit the southern part of the British Rail since the " blitz " years of World War Two. Excluding minor incidents, there were seventy cases of flooding, fifty " washouts ", where the ballast under the track was washed away, and nearly a hundred earth slips on embankments and cuttings. Over five feet of water lay over the rails at Hampton Court and at several stations, the water rose to platform level—even sweeping away the platform lamp standards at Godstone.

It took nearly three days for some of the floods to go down and only then could the work of repair begin. To replace soil wasted away, the Region used nearly 1,300 wagons of spoil and quarry dust—used for strengthening clay—which were already on the Region, while other Regions contributed another 360 wagons from places as far apart as Wigan, and Okehampton in Devon.

Just to show that B.R. kept its sense of humour during the crises, we heard that one of the wagon types used during the operation of repair became known to workers as " Mermaids " !

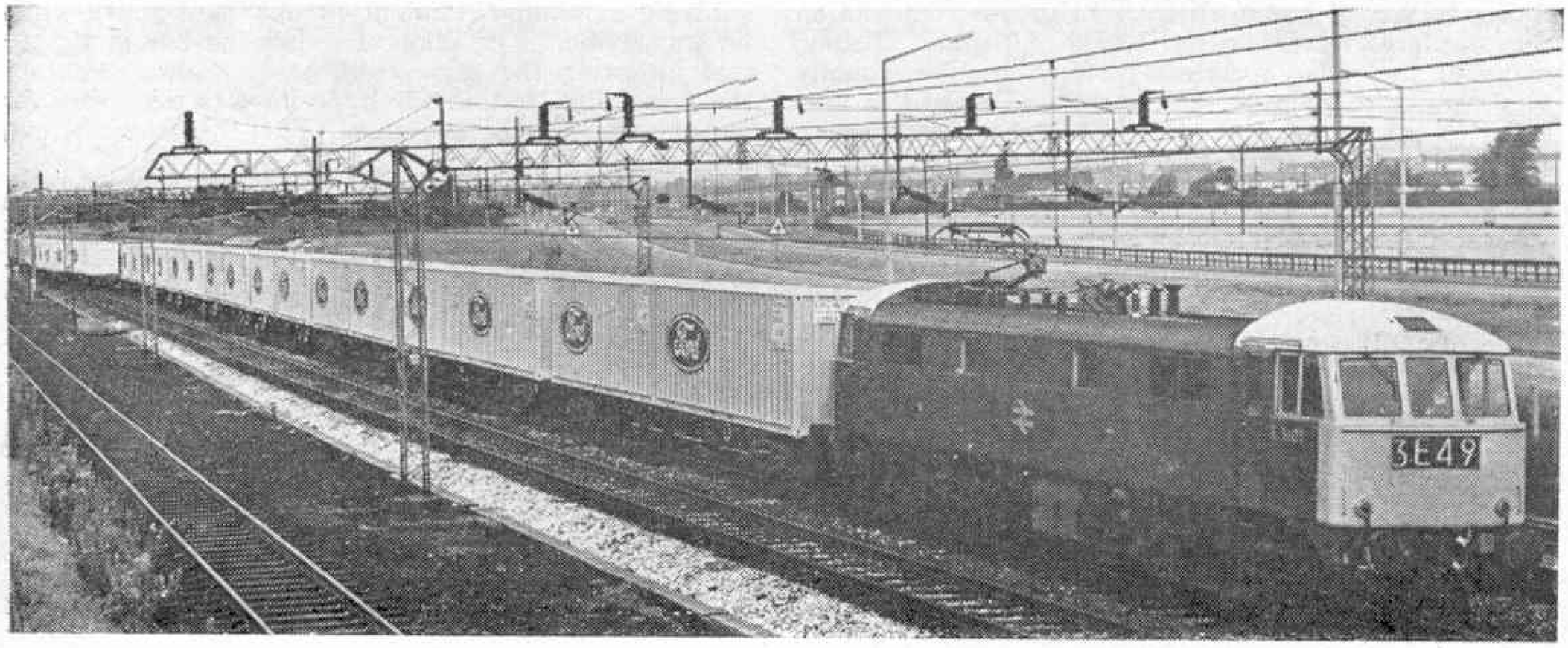
With considerable help from other Regions and by working day and night, the Southern's 2,700 engineers had reopened all but four passenger routes and one freight line within the week. Even with the help of " Mermaids ", the cost to the Region is estimated at roughly £300,000 !

Havoc may indeed reign for at least a little while on the Southern, but in the North, British Rail have succeeded in forming a new Freightliner service, said to be the first of its type in Britain, in that it is the first company Freightliner to run on British Railways. This will leave fords at Halewood daily at 0840 for Harwich, where the containers will be transferred to one of the two new B.R. Freightliner container ships for shipment to Zeebrugge, where they will be offloaded on to the European railway system. The containers will be loaded with Ford Escort components intended to be assembled at plants in important export markets.

Consisting of twenty-one Freightliner flats, each 62 ft. 6 in. long, the train conveys forty-two containers, each carrying twenty tons of components. Specially designed for side loading—unlike the normal Freightliner units which are end loading—in the new Halewood building now nearing completion.

One thing is certain, these new trains make a fine sight on North Western main lines, as our picture shows. A far cry from high speed freight trains in the North West, or for that matter, floods in the South, are the energetic group of enthusiastic volunteers that run the highly scenic Talyllyn Railway in North Wales. We hear that they have experienced yet another record year where passengers are concerned. Over 72 thousand were carried up to August this year, representing an increase of about ten per cent.

The Talyllyn Railway, with headquarters in Towyn, Merioneth, is run almost entirely by volunteers of all ages, and incidentally if you fancy the idea of working on a railway, I propose next month to tell you just how you can go about it. I have always thought that this is one preservation line that always welcomes volunteers of practically every kind and I am sure that if you are enthusiastic enough, a welcome would await you at Towyn. One of the oldest preservation societies to have actually acquired a railway without any big business strings attached, the Talyllyn recently announced their programme of work for the winter months, when of course passengers are practically non-existent. They intend laying a new passing loop at Quarry Siding, completely relaying the loop at Pendre, the completing of the locomotive shed extensions, also at Pendre, major repairs to Dolgoch Viaduct, and the provision of a new station at Abergynolwyn. No small programme indeed. Next month I will tell you how you can participate.



The new Freightliner train on its way to Harwich as it leaves the Halwood Plant of Fords in Liverpool.

Great Engineers No. 11

HENRY FORD

(1863–1947) by A. W. Neal

Below: Henry Ford's portrait and a picture of him some years later in the first car he produced. Known as a " Horseless Carriage " it was very frail and was steered with a tiller.

NOBODY CAN justly ask who was this man Ford ? What did he do ? The impression he made on the motor car industry is clear for all to see.

Henry Ford was the eldest of a family of four boys and two girls. His father, who was half Scottish and half Irish, owned a farm at Springwells Township, Michigan, U.S.A. As a young boy Henry Ford showed little interest in the chores of farming, whereas machinery seems to have captured his imagination at a very early date.

He attended Springwells' local school, but never learned to spell correctly, to read freely or to express himself well in writing. But he was a master of mechanical logic. At the age of 16 he became apprenticed to a firm of steam engine makers, and following this was appointed chief engineeer to the Edison Illuminating Company.

In the 1890's, Henry Ford began developing his ' horseless carriage '. By 1893 his first engine was completed, and just three years later he finished his first car. Soon afterwards he organised the Detroit Automobile Company and he was appointed chief engineer, but by the end of the century the company had become bankrupt.

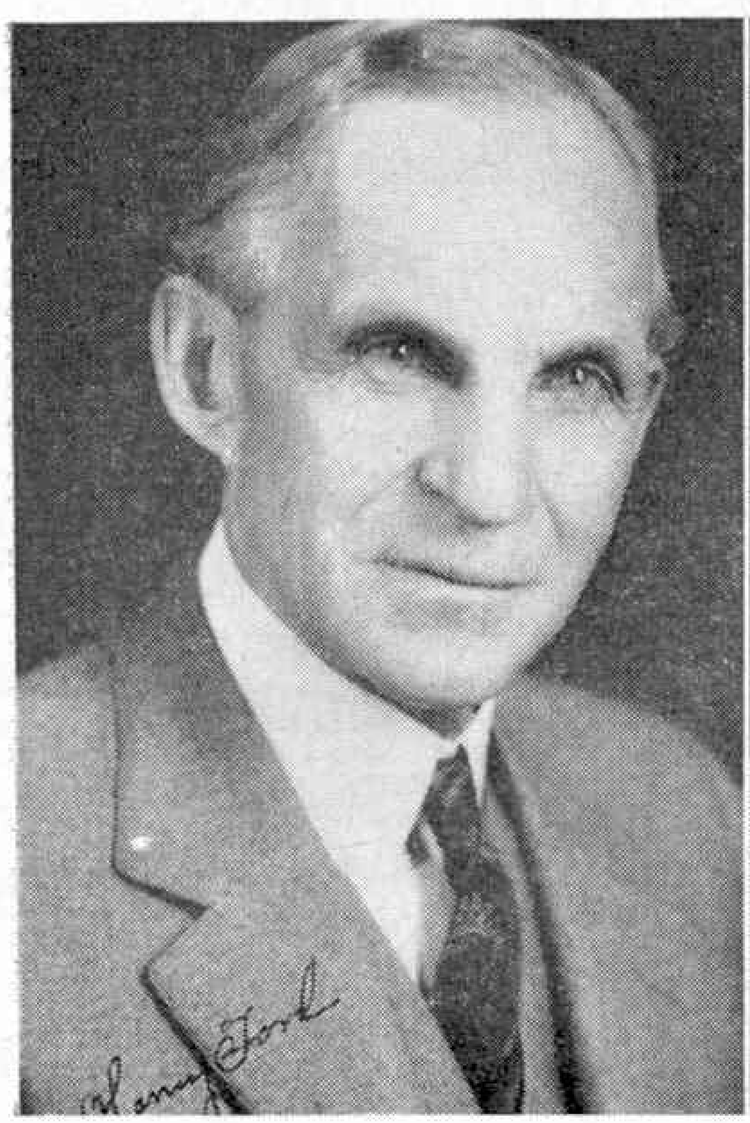
Subsequently he constructed other cars and began racing them. In 1903, Ford obtained sponsors and founded what was to become the Ford Motor Company. This inexperienced company met with many difficulties, including legal ones. But Ford continued improving his car, always aiming at a vehicle cheap enough for the average man to purchase. In 1908 he introduced his famous Tin Lizzie—the Modei T—which the enthusiastic public rushed to purchase. The rising demand for this car called for additional production facilities and a new factory was established at Highland Park. Assembly facilities were also provided at Kansas City in 1911.

But the vehicle was practically hand-built, and it was becoming difficult to keep abreast with the inflow of orders. This led to the introduction of the moving assembly line and mass production. Originally it took 12 hours and 28 minutes to put together a Model T, but the time was then reduced to 5 hrs. and 50 mins., and later to 93 minutes. Ford aimed at a car a minute, but eventually there was a car for every 10 seconds of the day. His next vehicle, the Model A, was introduced in 1927, by which time over ten million Tin Lizzies had been built and the shock news of a new model being introduced to replace the Model T closed Wall Street for a whole day !

In 1925 the construction of the first triple-engine aeroplane was completed as a result of Edsel's (Ford's son) interest in aviation. And during World War II came the ' Liberator ' bombers. The history of the Ford organisation is one of unbroken development, but we are concerned here with the man.

It has been said that Henry Ford put America on wheels and that he rescued thousands of people from their isolation and thereby changed their way of life. His moving assembly lines showed the way to a fresh approach to mass methods of production in many kinds of industry and paved the way to higher standards of living.

One can see, just by looking at the hundreds of thousands of Ford cars on the road today, that if Henry Ford had not been alive, many of us would not be driving a car today.



A WHIFF OF BY-GONE TIMES

Spanner describes two models that capture the lines of two classical sports cars, now almost extinct on today's roads

PERHAPS IT'S my imagination, but cars, these days, seem to be growing more and more alike. Different makes can sometimes quite easily be confused and even sports cars are beginning to look like saloon cars or vice versa. It hasn't always been like this, however. In times gone by, a saloon car was a saloon car and a sports job could not possibly be confused with it. I might add, incidentally, that the sports cars of the time really appeared far more "sporty" than their counterparts today although I do not of course suggest that they were any better as far as performance went.

It is easy to follow the changes in motor car design over the years by looking through old issues of *Meccano Magazine*. The car models featured there tend to mirror the real-life vehicles in use at the time of publication and you will see that this is so from the two models described here. Both are based on models found in past issues of the M.M. and I think you will agree that both are really distinctive in design.

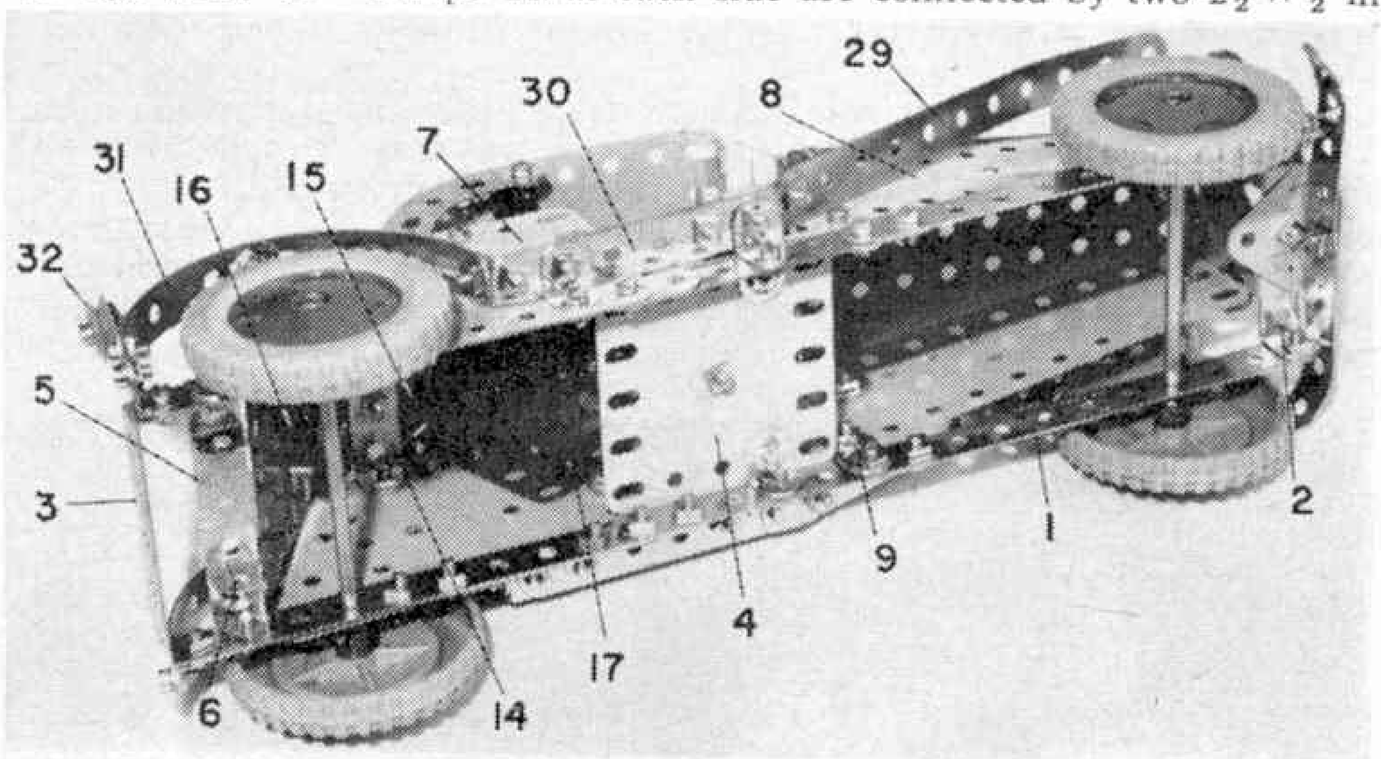
The first is reminiscent of the famous Morgan three-wheeler, easily recognised by the twin-cylinder motor cycle engine mounted in front of the bonnet and open to the atmosphere. The model, however, draws its power from a Magic Motor.

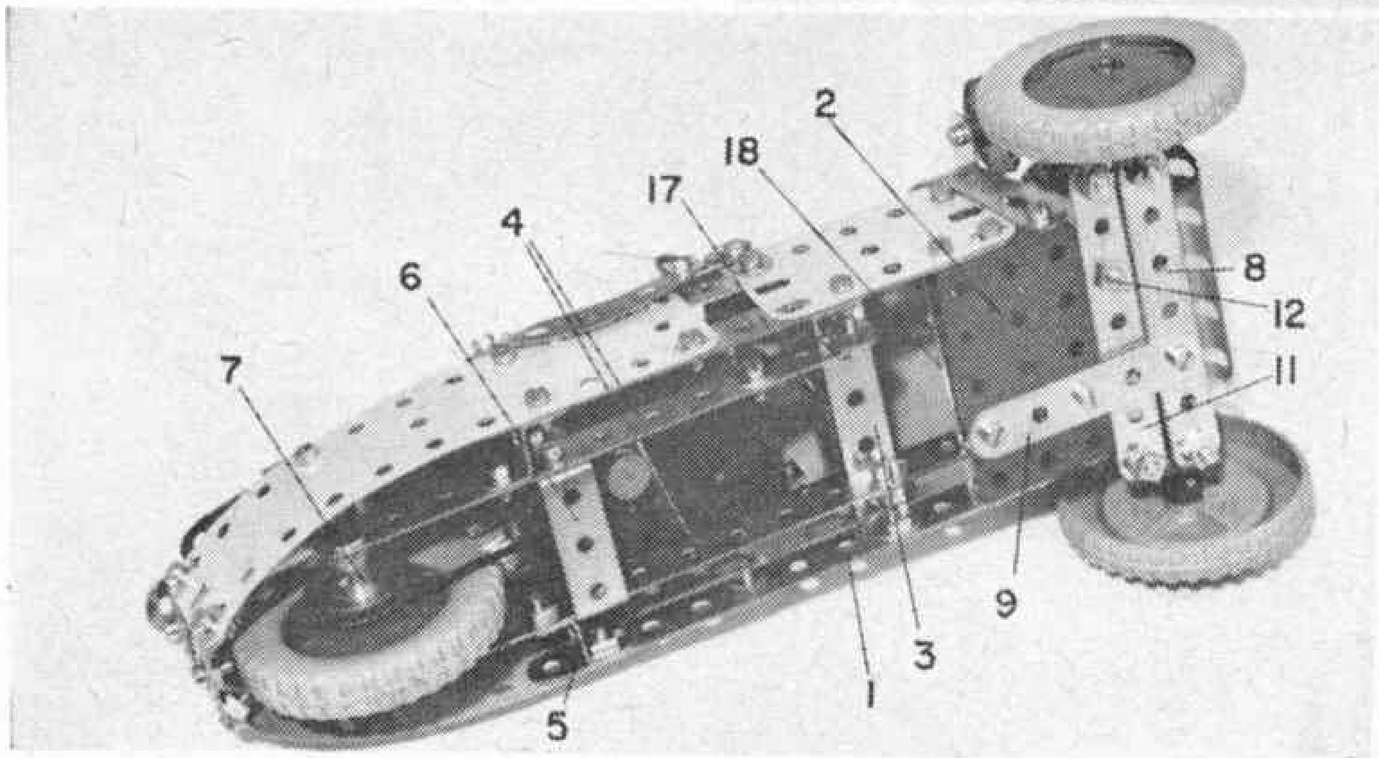
Constuction is not difficult. Beginning as usual with the chassis, two $5\frac{1}{2}$ in. Strips 1 are joined by a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flanged Plate 2 and a $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip 3. Note that the Flanged Plate projects a distance of one hole beyond the ends of the $5\frac{1}{2}$ in. Strips. A further two $5\frac{1}{2}$ in. Strips 4 are attached to Double Angle Strip 3 by Angle Brackets and to Strips 1 by Reversed Angle Brackets 5, then a $1\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip 6 is bolted between Strips 4, as shown. Held by Spring Clips in the rear end holes of Strips 4 is a 2 in. Rod carrying a 1 in. Fixed Pulley 7 and a centrally-mounted $2\frac{1}{2}$ in. Road Wheel.

Now bolted to Flat Plate 2 is a $2\frac{1}{2}$ in. Strip 8 to the end of which a $3\frac{1}{2}$ in. Strip 9 is fixed at right angles. A Fishplate is lock-nutted to each end of this Strip, the securing Bolt also firmly fixing a Double Bracket 10 in place, then the Fishplates are further joined by a second $3\frac{1}{2}$ in. Strip 11, lock-nutted in place. Two Angle Brackets arranged in an open-ended "V" shape are fixed to the top of Strip 11 by Bolt 12. A $1\frac{1}{2}$ in. Rod is journalled in the lugs of each Double Bracket 10 to be held in place by a Spring Clip and a $2\frac{1}{2}$ in. Road Wheel.

At this stage, the Magic Motor can be fitted, being attached to Fishplates bolted to Strips 4. Bolted to the brake lever of the Motor is a $1 \times \frac{1}{2}$ in. Double Bracket in the lugs of which a 2 in. Rod extended by a Rod Connector 13, is held by Spring Clips. The Pulley on the Motor output shaft is connected to Pulley 7 by a Driving Band.

Turning to the body, each side is similarly built up from a $5\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 14 and a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 15, is bolted to Strip 1, a distance of one hole separating the Plates. Another $5\frac{1}{2}$ in. Strip 16 is bolted between the upper edges of the Plates then Strips 16 at each side are connected by two $2\frac{1}{2} \times \frac{1}{2}$ in.



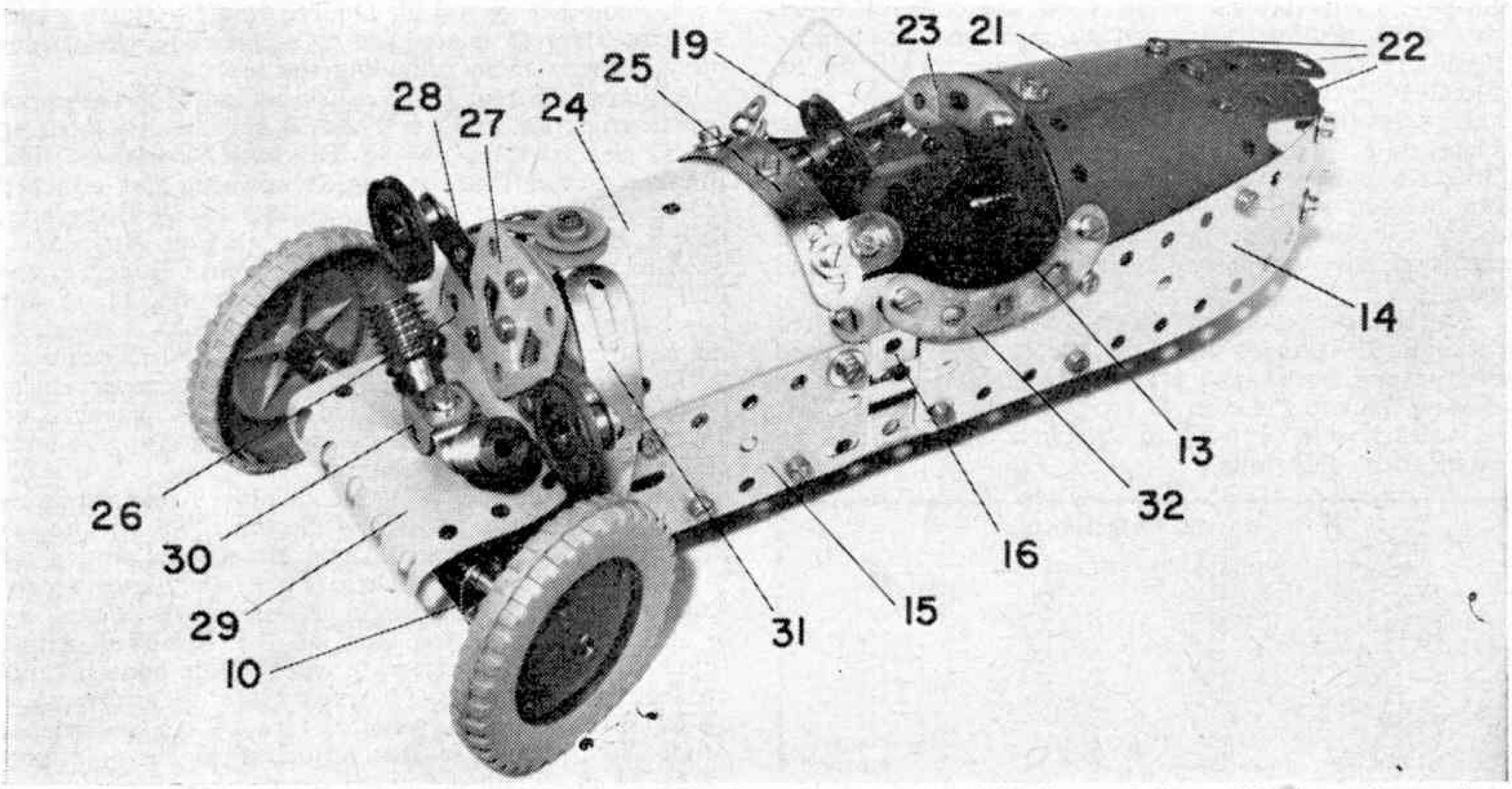


Above right: One of the most easily-recognisable sports cars of recent times was the Morgan three-wheeler, renowned for its "open-air" engine. This simple Meccano model, based on the Morgan, is powered by a Magic Clockwork Motor.

At right: For "sporty" looks, you can't beat the pre- and early post-war sports cars. This Meccano model is very reminiscent of such oldies.

Above: The simple but functional chassis of the model is clearly shown in this photograph.

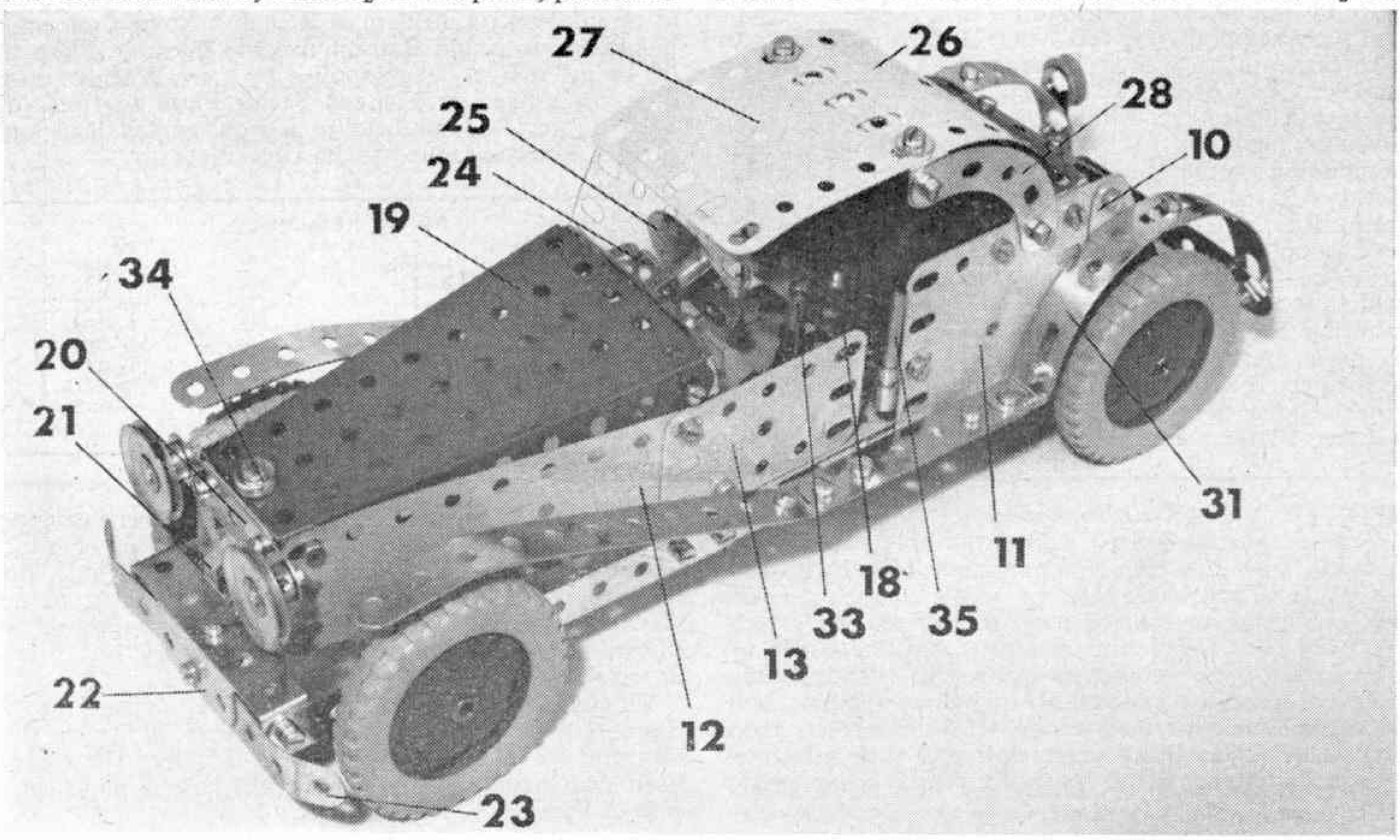
At left: An underside view of the three-wheeler showing the layout of the chassis and steering gear.



Double Angle Strips 17 and 18. A Fishplate is bolted through the second hole from the right of Double Angle Strip 17, the circular hole in the Fishplate, along with the corresponding hole in Double Angle Strip 18 providing the bearing for a $3\frac{1}{2}$ in. Crank Handle which acts as the steering column. The handle section of this Crank locates between the Angle Brackets held by Bolt 12, while a 1 in. Pulley 19 is fixed on the opposite end of the Crank Handle to serve as the steering wheel.

At the rear of the car, Plates 14 are joined by four Obtuse Angle Brackets 20 arranged in pairs, then the back is completed by a $4\frac{1}{2} \times 2\frac{1}{2}$ in. Plastic Plate 21 extended rearwards by three $2\frac{1}{2}$ in. Strips 22, positioned as shown. A $2\frac{1}{2}$ in. Stepped Curved Strip 23 is attached to the front edge of the Plate by an Angle Bracket.

The bonnet is represented by a $4\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 24 to which a Formed Slotted Strip 25 is bolted, the end securing Bolts also fixing two Obtuse Angle Brackets in place. A $2\frac{1}{2} \times 1\frac{1}{2}$ in. Transparent Plastic Plate is attached to these Brackets to serve as the windscreen. Attached to the front of Plate 24 is a $\frac{1}{2}$ in. Pulley without boss, the securing Bolt also holding an Angle Bracket to which a Semi-circular Plate 26 and a Flat Trunnion 27 are bolted, the Trunnion being spaced from the Plate by a Washer. Bolted in place between the Trunnion and the Plate are two $2\frac{1}{2}$ in.



Strips 28, overlapped 3 holes, to the ends of which two 1 in. Pulleys are fixed to represent headlamps. Semi-circular Plate 26 is extended by a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 29, shaped as shown to cover the front axle assembly. Held by Nuts in the centre of this Plate is a $\frac{1}{2}$ in. Bolt on which two Obtuse Angle Brackets and an ordinary Angle Bracket 30 are held as can be seen in the illustration. Two Worms are fixed to the Obtuse Angle Brackets to give an indication of the distinctive engine cylinders present on the actual vehicle.

Finally, two Formed Slotted Strips 31 are bolted through the unused holes in the flanges of Flanged Plate 2 and are shaped over the front of the bonnet as shown. Plastic Plate 21 is connected to Flexible Plate 24 at each side by a $2\frac{1}{2}$ in. Stepped Curved Strip 32 extended by a Fishplate.

PARTS REQUIRED

6—2	1—19s	1—51	2—189
2—3	2—22	3—90a	1—190
6—5	1—23	1—111a	1—191
7—10	2—32	5—111c	1—193
2—11	6—35	2—125	1—194c
1—11a	70—37a	1—126a	1—213
7—12	58—37b	1—186a	1—214
8—12c	7—38	3—187	3—215
2—17	1—48	2—188	1—Magic Motor
2—18a	3—48a		

Our second model is easily recognisable as a sports care similar to the pre- and early post-war M.G.'s To build it, two chassis members 1 are each built up from two $5\frac{1}{2}$ in. Strips joined by a $3\frac{1}{2}$ in. Strip to result in a $12\frac{1}{2}$ in. compound strip, then the members are joined by two $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strips 2 and 3, a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 4, attached by Angle Brackets, and a $2\frac{1}{2}$ in. Strip 5 attached by Double Brackets 6. Fixed to the right-hand chassis member, in the positions shown, are a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Triangular Flexible Plate, a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 7 and a $5\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 8, the last attached at one point only by means of a Fishplate as at 9.

In the case of the left-hand chassis member, this also carries a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Triangular Flexible Plate 10 and a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 11, but, unlike the other side, these are "butt-jointed" by a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate. A $5\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 12 corresponding with Plate 8, is included but on this occasion is extended 2 holes rearward by a second $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 13.

The upper rear corners of Plates 7 and 11 are now connected by a $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip 14 to which a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 15 is bolted, the securing Bolts also fixing two Obtuse Angle Brackets in place. Attached to these Obtuse Angle Brackets is a further, shaped, $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 16 extended by a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Plastic Plate. Also bolted between Plates 7 and 11 is a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flanged Plate 17 and another $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip to which a $2\frac{1}{2}$ in. Strip 18 is attached by a Fishplate, these three parts between them providing the seat.

A Flanged Sector Plate 19 is now bolted to the upper front corners of Flexible Plates 8 and 12, the securing Bolts also holding Angle Brackets in place. The Flanged Sector Plate is angled upwards and attached to the rear corners of Plates 8 and 12 by Fishplates, then a Flat Trunnion overlaid by a $2\frac{1}{2}$ in. Strip 20 is fixed to the Angle Brackets at the front. Bolted to the Flat Trunnion is an ordinary Trunnion 21 to the lower flange of which a second Trunnion 22 is attached, the securing Bolt also serving to fix both Trunnions to Double Angle Strip 2. The front bumper is represented by a shaped $4\frac{1}{2}$ in. Strip 23 attached to Trunnion 22, while 1 in. Pulleys are fixed to the ends of Strip 20 to act as headlamps.

Next, another $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip is bolted between the flanges of Sector Plate 19 and, to this, is fixed a Reversed Angle Bracket 24 and a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Transparent Plastic Plate, the latter representing the windscreen. An 8-hole Bush Wheel 25 is attached to the free lug of the Reversed Angle Bracket to act as the steering wheel. The hood is built up from a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Curved Plate 26 and a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 27 bolted to a $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip which is then attached to Plates 7 and 11 by $2\frac{1}{2}$ in. Stepped Curved Strips 28.

Two sets of combined mudguards and running board are each produced from a $5\frac{1}{2}$ in. Strip 29 attached by an Obtuse Angle Bracket to a 3 in. compound strip 30, obtained from two $2\frac{1}{2}$ in. Strips which is in turn attached by an Angle Bracket to two Formed Slotted Strips 31. The whole thing is attached to the appropriate chassis member by Angle Brackets. The wheels themselves are $2\frac{1}{2}$ in. Road Wheels fixed on $3\frac{1}{2}$ in. Rods journalled in the chassis members.

The model is completed by the addition of (a) a rear light, represented by a $\frac{1}{2}$ in. Pulley 32, attached by an Obtuse Angle Bracket to the right-hand rear mudguard; (b) by an imitation gear lever supplied by a $1\frac{1}{2}$ in. Rod 33 held in a Rod and Strip Connector bolted to an Angle Bracket fixed to Flexible Plate 7; (c) by a "mascot" 34 supplied by three Washers on a $\frac{3}{8}$ in. Bolt fixed in Flanged Sector Plate 19; and (d) by a $1\frac{1}{2}$ in. Rod 35 held in a right-angled Rod and Strip Connector bolted to Flexible Plate 11.

PARTS REQUIRED

6—2	1—18b	1—54	2—189
2—3	2—22	2—90a	4—190
9—5	1—23	5—111c	1—193
5—10	1—24	1—125	1—194
2—11	82—37a	2—126	1—200
12—12	80—37b	1—126a	1—212
5—12c	6—38	4—187	1—212a
4—16	6—48a	4—188	4—215
1—18a	1—51		

BATTLE *(continued from page 642)*

an enemy rumbling into sight, was able to draw an immediate bead on him and slam a shell forthwith into his vitals. Tank battles *did* go on for longish periods, and our desire to achieve some sort of realism closely coincides with the desire to ensure that the battle we are engaged in is not over in a matter of a few minutes.

It will be seen that some of the lighter weapons have no strike value at long range—this is correct, their muzzle velocities being pretty low and their effectiveness at anything above medium range being pretty feeble.

The range of some of the most powerful guns extends as we have already seen up to the equivalent of 2000 yards, or 60 in. This is not included in the Table, for the simple reason that visibility will be found to be rarely sufficient for efficient firing at this range to be carried out, particularly where the country is 'close' or wooded and hilly.

Finally, the result of the shot did depend on a couple of obvious conditions—whether it struck the target at which it was aimed, and if indeed the target itself was visible. These points will be our main concern in Part IX.

BUILDING A BILLING BOAT KIT

SOME OF you may have heard of Billing boat kits, many of you will not, so before we describe one of these kits, a word or two about their origin. Billing kits are made in Denmark and imported into this country by Contarnex Ltd. of Croydon, who distribute them to the model shops. The kits are super detailed, and designed for construction in the traditional full size manner, i.e., the fitting of a number of ribs onto a keel piece, which are in turn covered with planks nailed in position. Although there are many kits in the Billing range, I have only had the opportunity to construct one. To do one of these kits justice, somewhere in the region of 200 hours must be spent on construction, so it is impossible to churn models out as one could were they plastic kits. However, the prime purpose of this article is to describe the kind of job you take on when you start on one of these kits, so I'd better get down to it !

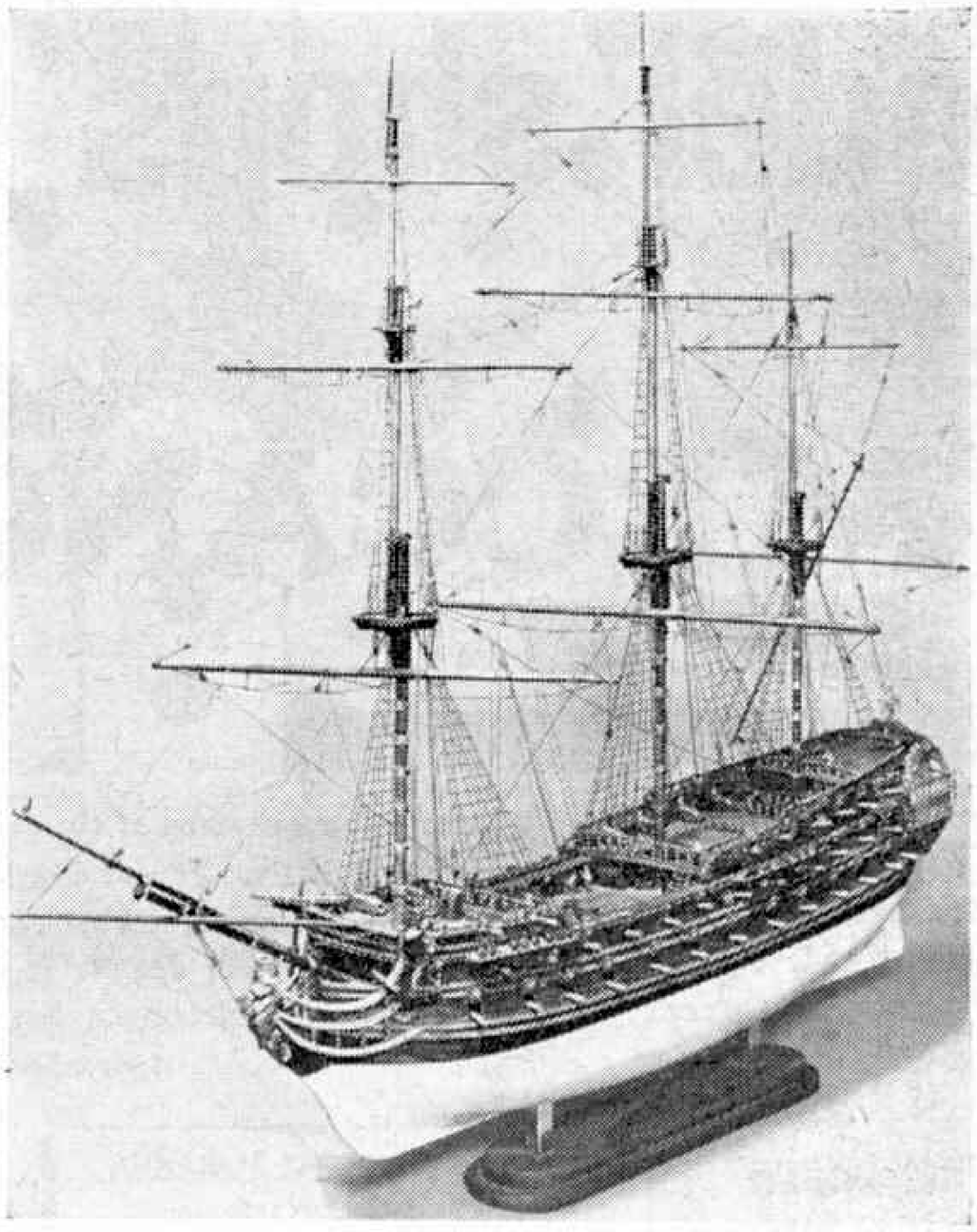
The model constructed was the trawler called **" Progress ".** This is an attractive modern vessel with plenty of space for the fitting of an electric motor, radio control unit and the numerous batteries, etc., that go with this equipment, and this particular model fitted my requirements admirably.

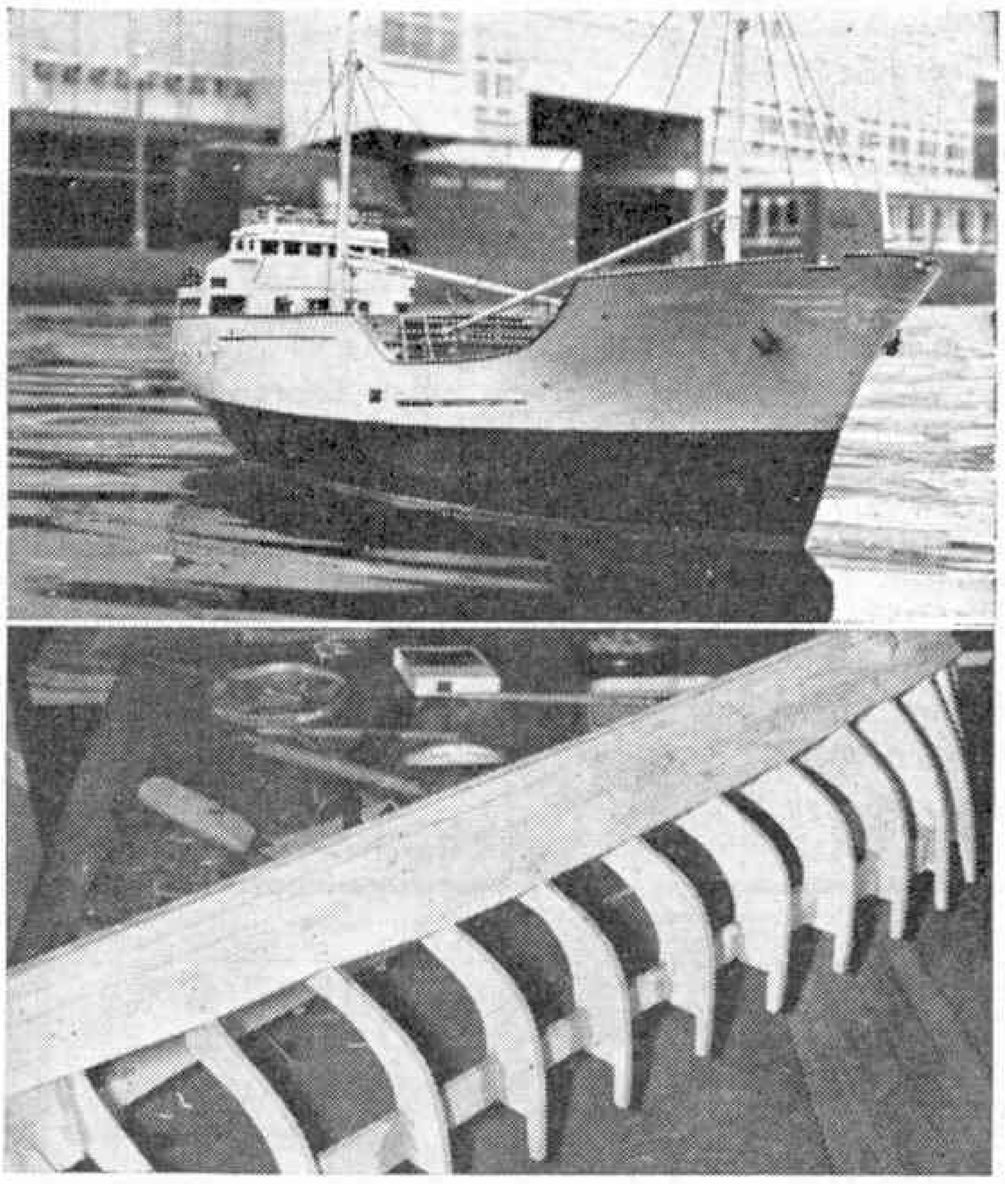
Firstly, to familiarise you with the kit, a brief run-down on its contents. All the 16 bulkheads and the keel are pre-cut from 3-ply $\frac{3}{16}$ in. thick, making the basic structure a very simple job to assemble. All the planks to complete the hull are provided, pre-cut from soft wood. The deck, wheelhouse and hatches are all marked onto sheets of plywood and softwood, and only need a couple of hours patient work with a fretsaw to shape up.

The deck fittings and mast accessory packs are a must to make a really good model, as they add so much realism. The mask pack contains two masts machined from brass, and two spars that fit to the rear mast. The fittings pack contains all the usual bits and pieces, i.e., bollards, stanchions, window frames and portholes, etc., and it is advisable to buy both the mast and accessories while you are building, as it's a bit of a job to fit parts after the model has been completed! The cost of the kit and accessory packs are as follows: Boat kit £5 . 18 . 6. Accessory pack £8 . 14 . 0. Mast pack £3 . 7 . 0.

The kit is built in the conventional full size manner, i.e., from the bottom up. The most difficult job requiring the greatest patience was trimming, shaping and nailing on the hull planks. However, the end result looks very nice if done carefully. To give extra strength to the finished hull apply a thin coating of " Cataloy " glass fibre resin. This also reinforces any weak spots that there might be.

The deck is all one piece and only needs staining with a suitable wood stain to give it an authentic appearance. The cabin/wheelhouse is (as I mentioned earlier) constructed basically of plywood and softwood, although the window frames, portholes, etc., take up most of the time in completing the unit. The funnel has to be carved from a block of balsa, using a detailed drawing in the instructions as a guide. The uprights for the handrails are provided. The actual rails are constructed from thin wire which must be threaded through small holes in the uprights and soldered. These kits are primarily intended for display rather than active use and they are almost too good to risk on the pond. The most important point about all these kits is a simple one. The more time you spend on a model the better it will look. These are not for the raw novice, but those slightly experienced in modelling should be able to construct a really nice model.





Top: The Norwegian Lion, a model rich in small details. Centre: The modern coaster Mercantic, one of the simpler Billing kits to build and suitable for radio control. Bottom: Partially planked hull of the tug Progress during construction.

model shops who specialise in MECCANO spare parts

Dealers wishing to advertise on this page should contact **MECCANO LTD., LIVERPOOL direct,** M.A.P. do not accept bookings for this page.

Listed below are some of the dealers who sell Meccano accessories and spare parts. This is intended to aid enthusiasts—and there are many of them—who constantly require additional spare parts for their sets. All dealers can, of course, order Meccano spare parts for their customers, but those listed here are among our spare part specialists.

C. G. MARSHALL
Maxwell Road
BEACONSFIELD
Telephone: 4092

TAYLOR & McKENNA
203 Marlowes
HEMEL HEMPSTEAD,
HERTS.
Tel: Hemel Hempstead 53691

"WALKERS"
15 St. Thomas Street,
SCARBOROUGH, YORKS.
Tel: SCARBOROUGH 3223
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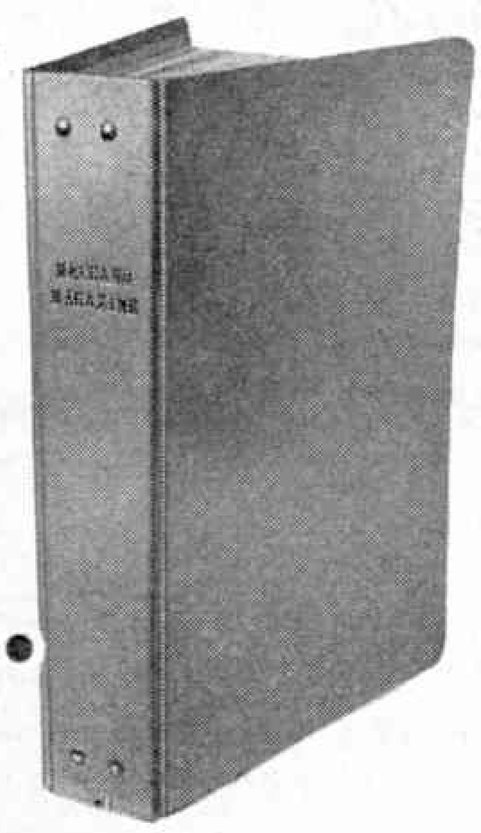

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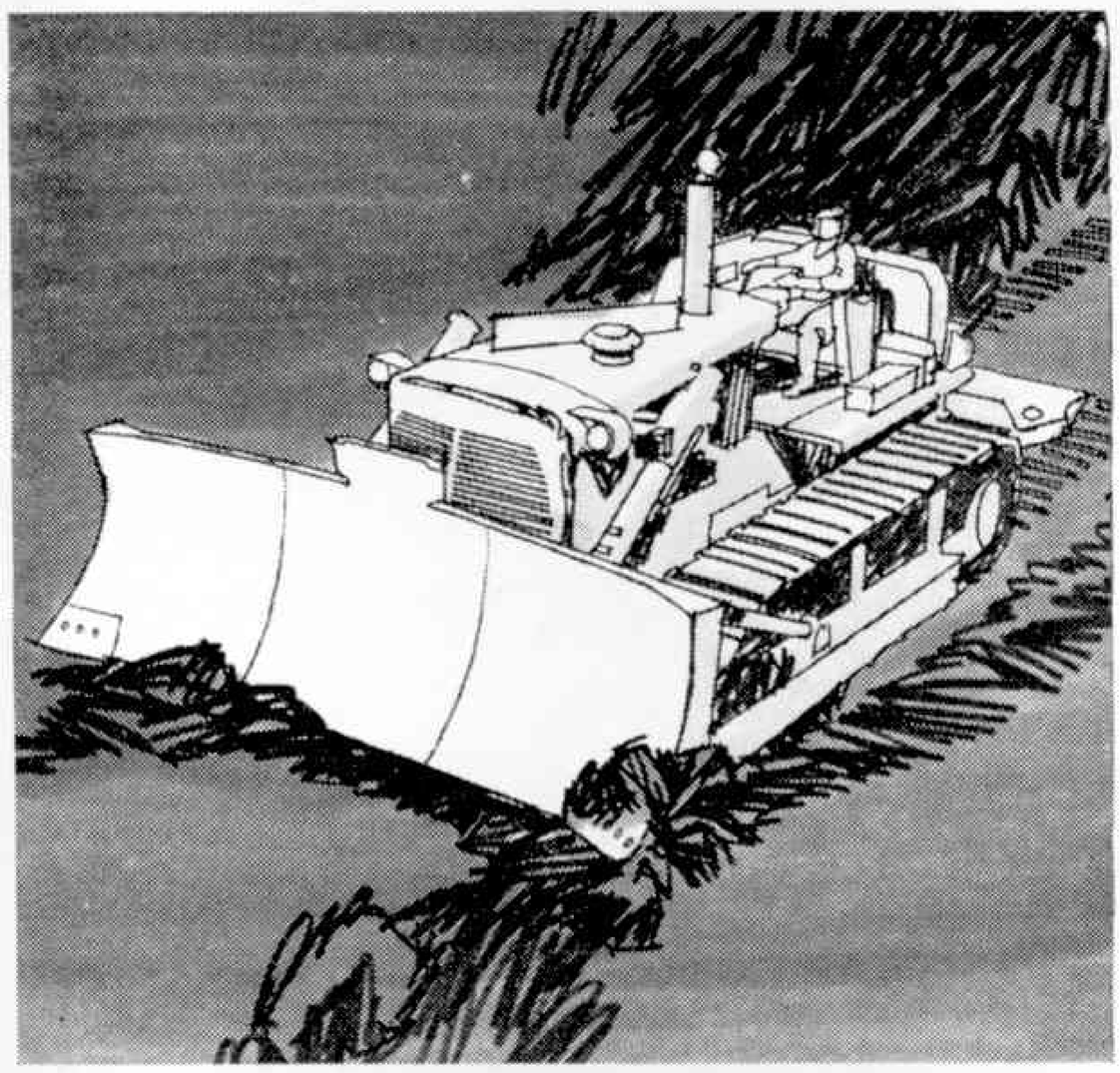

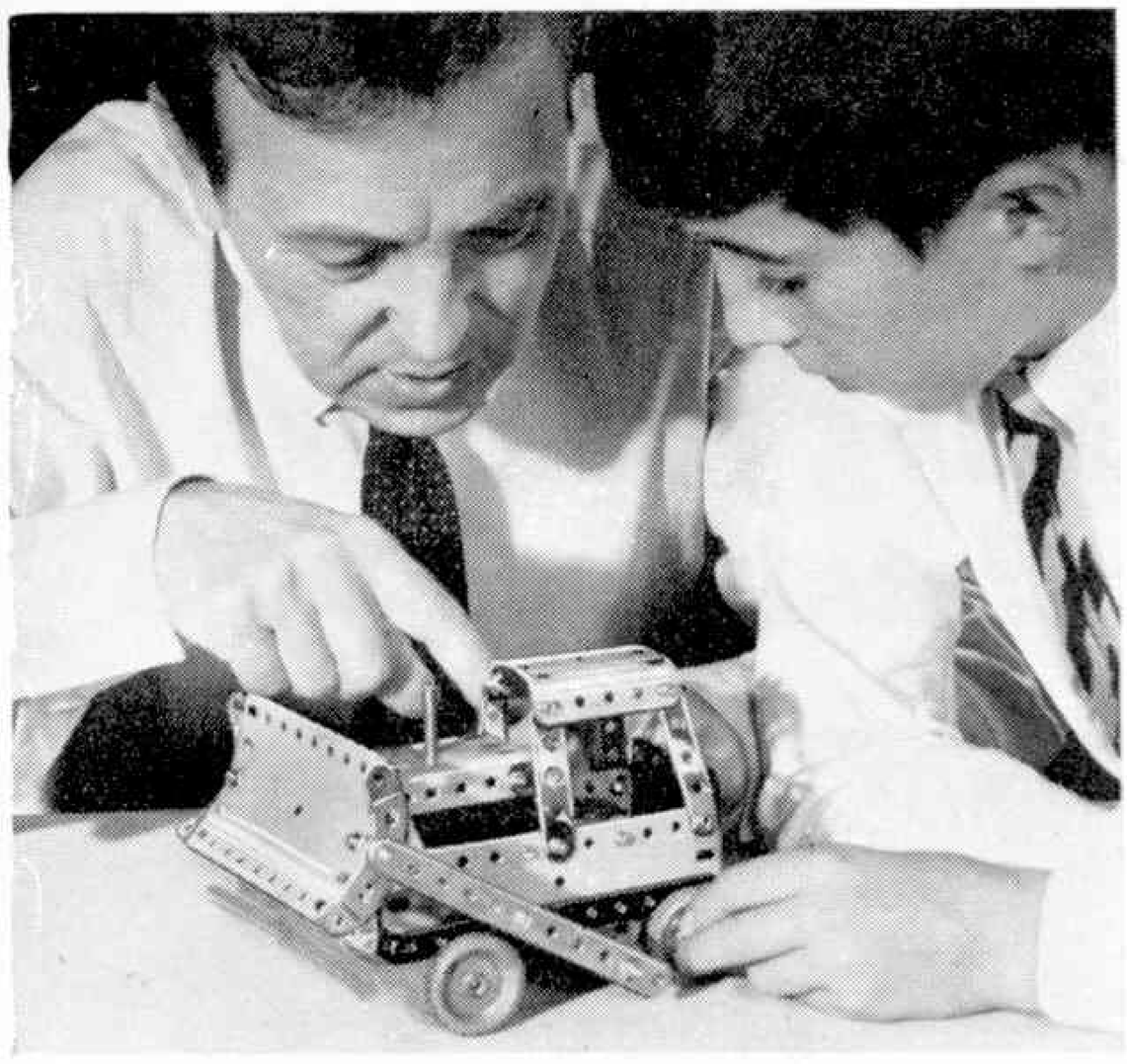

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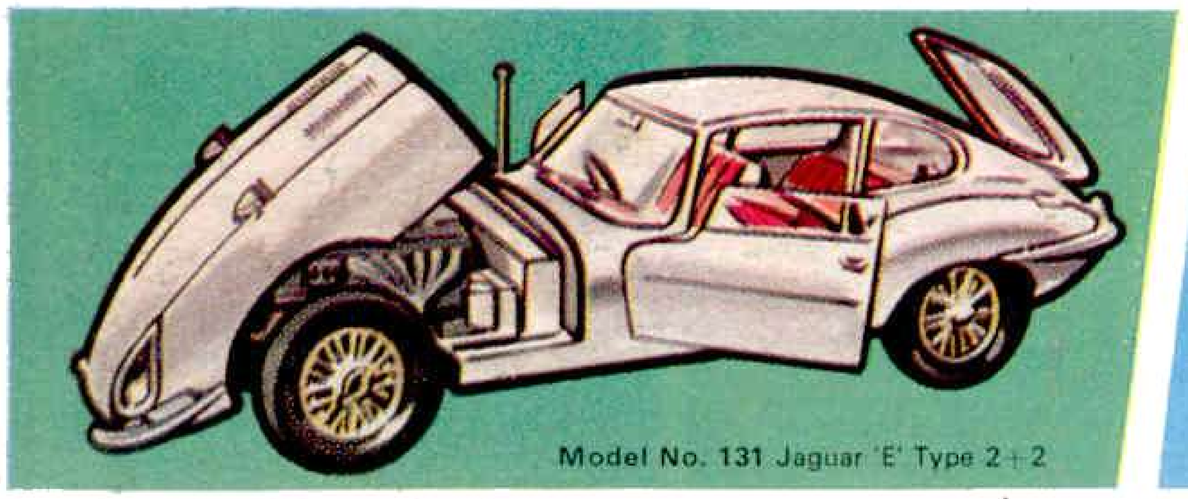

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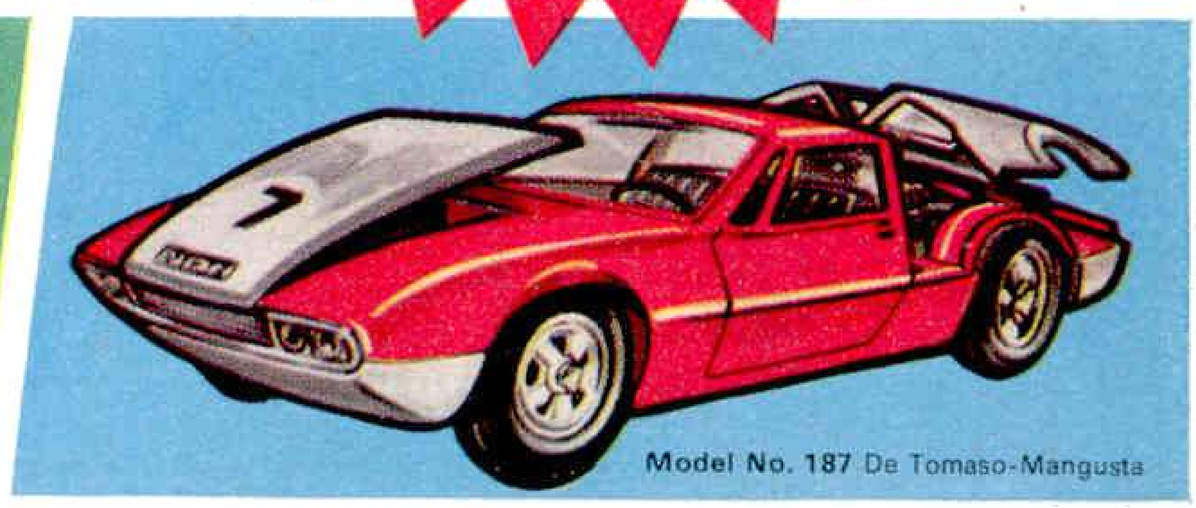

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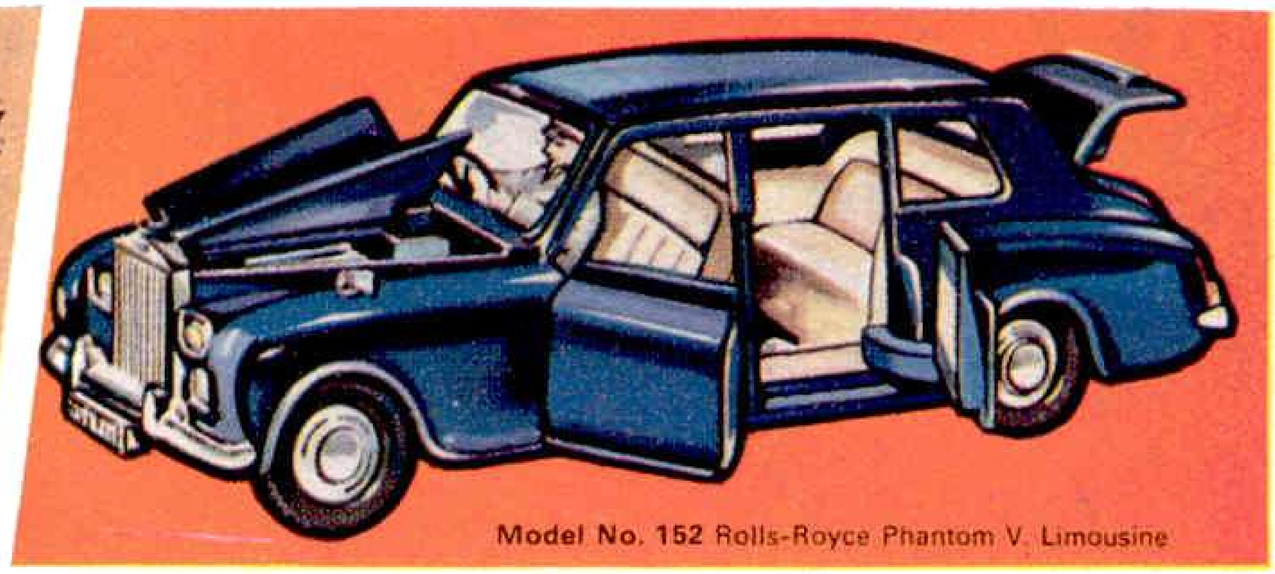

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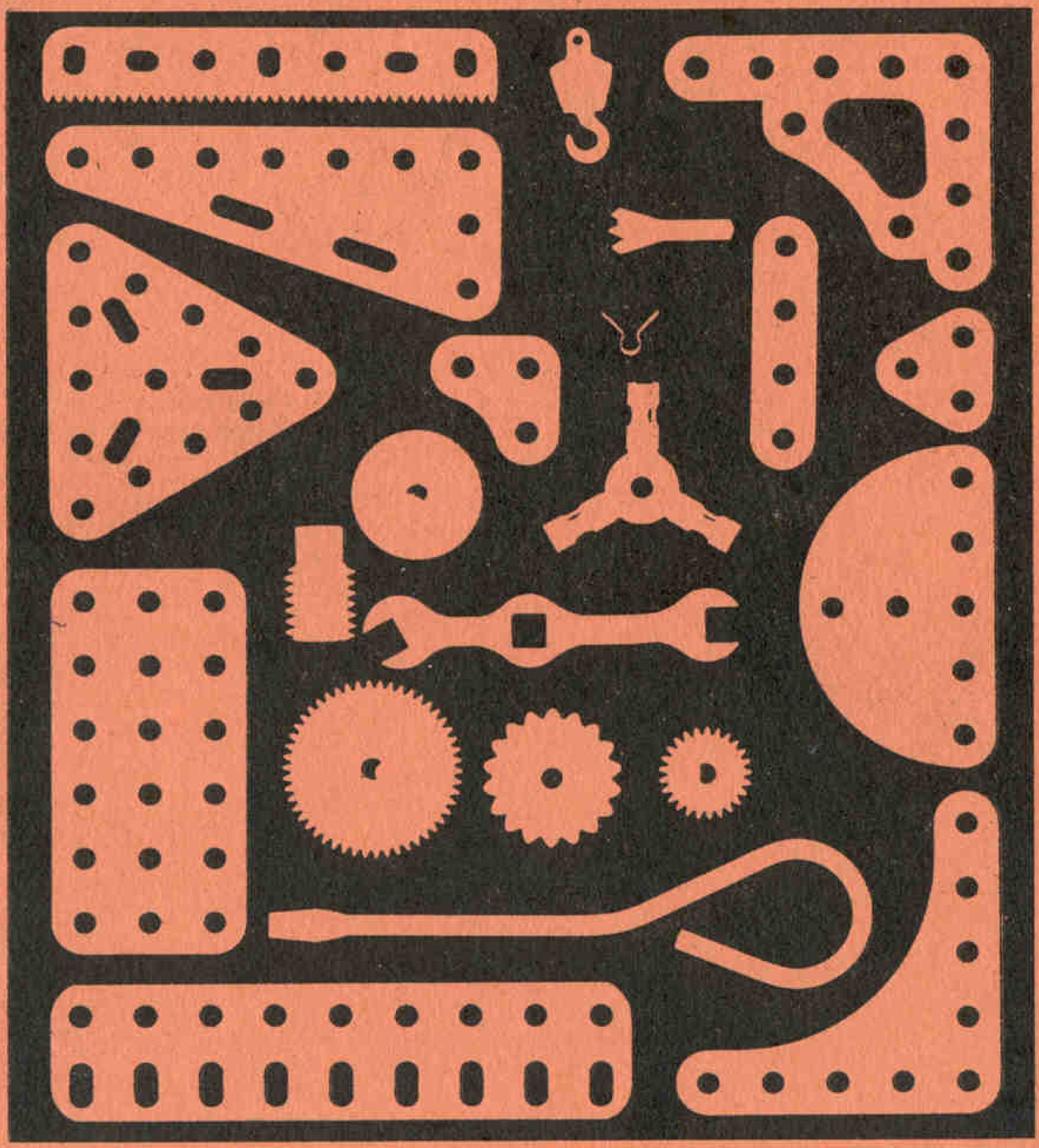

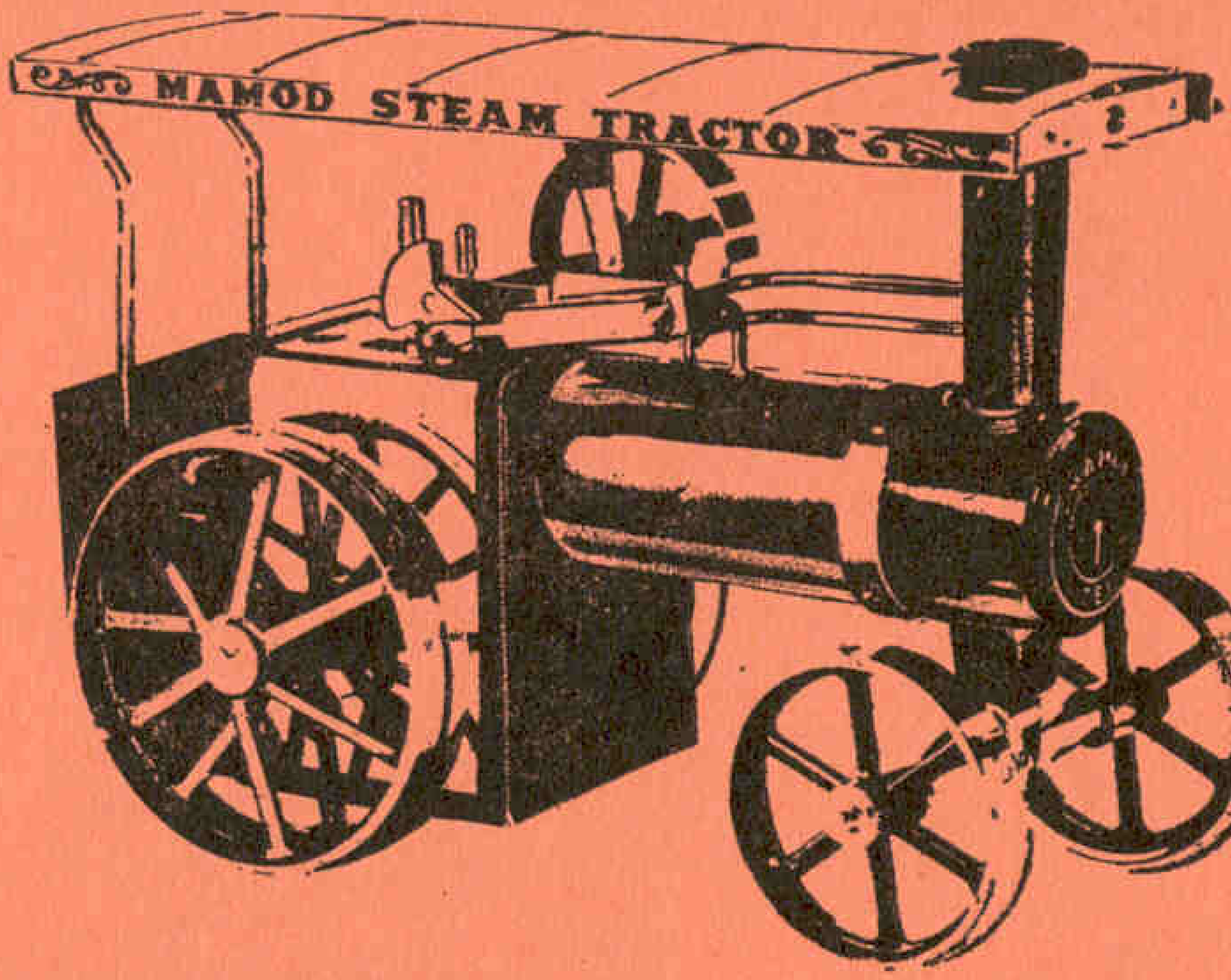

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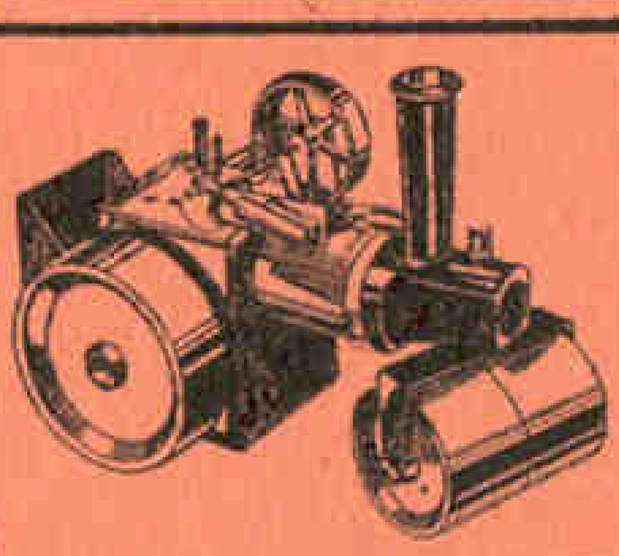

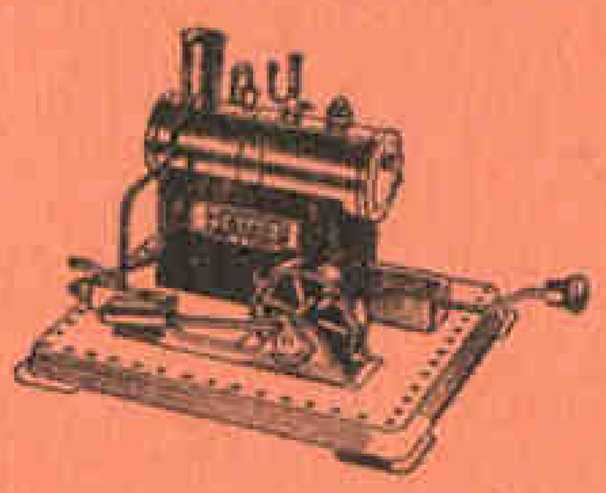

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CONTENTS

Making Meccano Parts	6
What shall I build next ?	13
General hints on model building	19
Some useful mechanisms for Meccano models	24
Motors and special outfits	29
Meccano dealers directory	34
Plastic Meccano	43
Meccano in industry and research	47
Meccano spare parts	51
The easy way to learn	55
Forming a Meccano club	58
Meccano – Its origin and history	60
Giant Meccano models	65
Meccano big wheel	66

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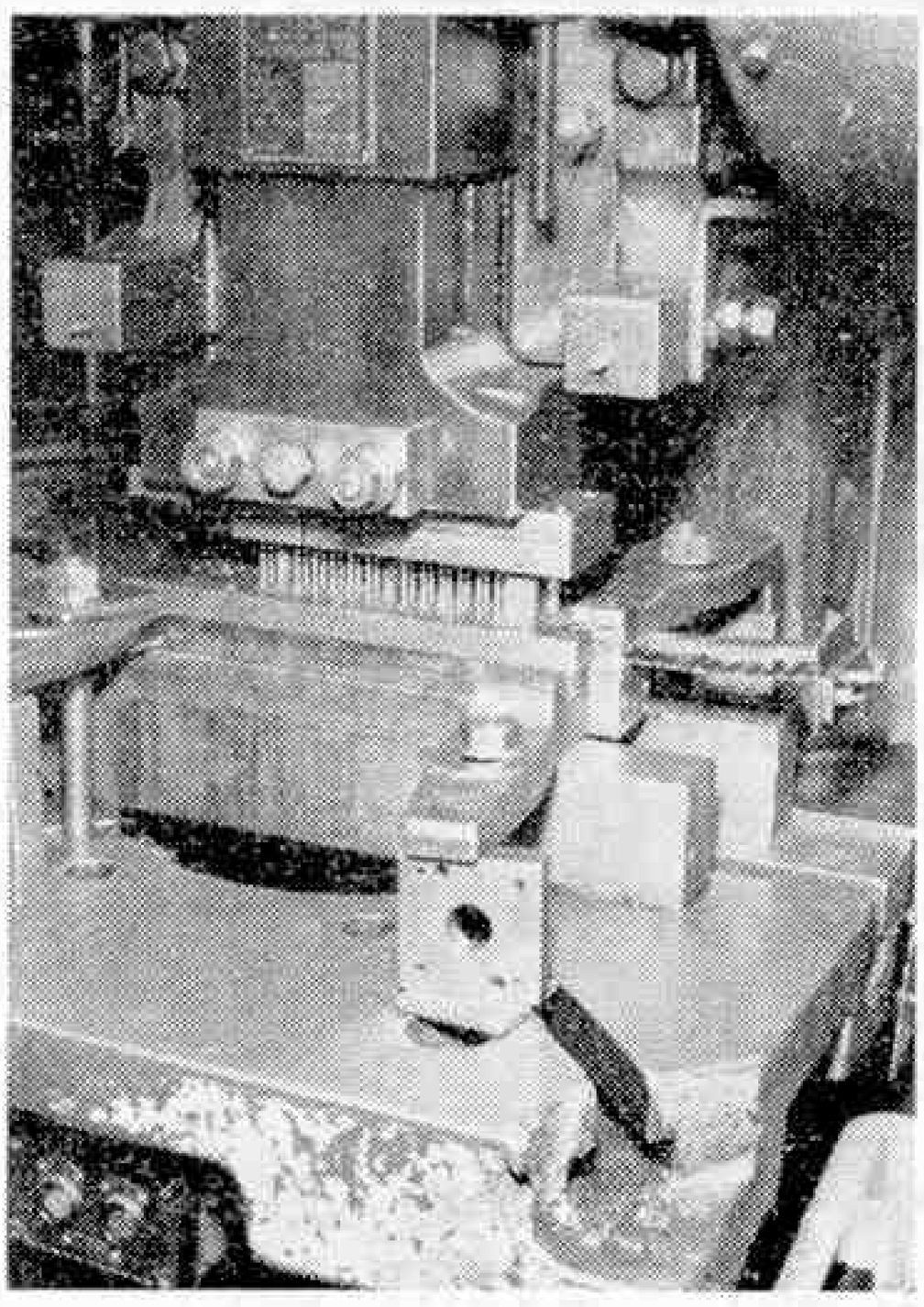
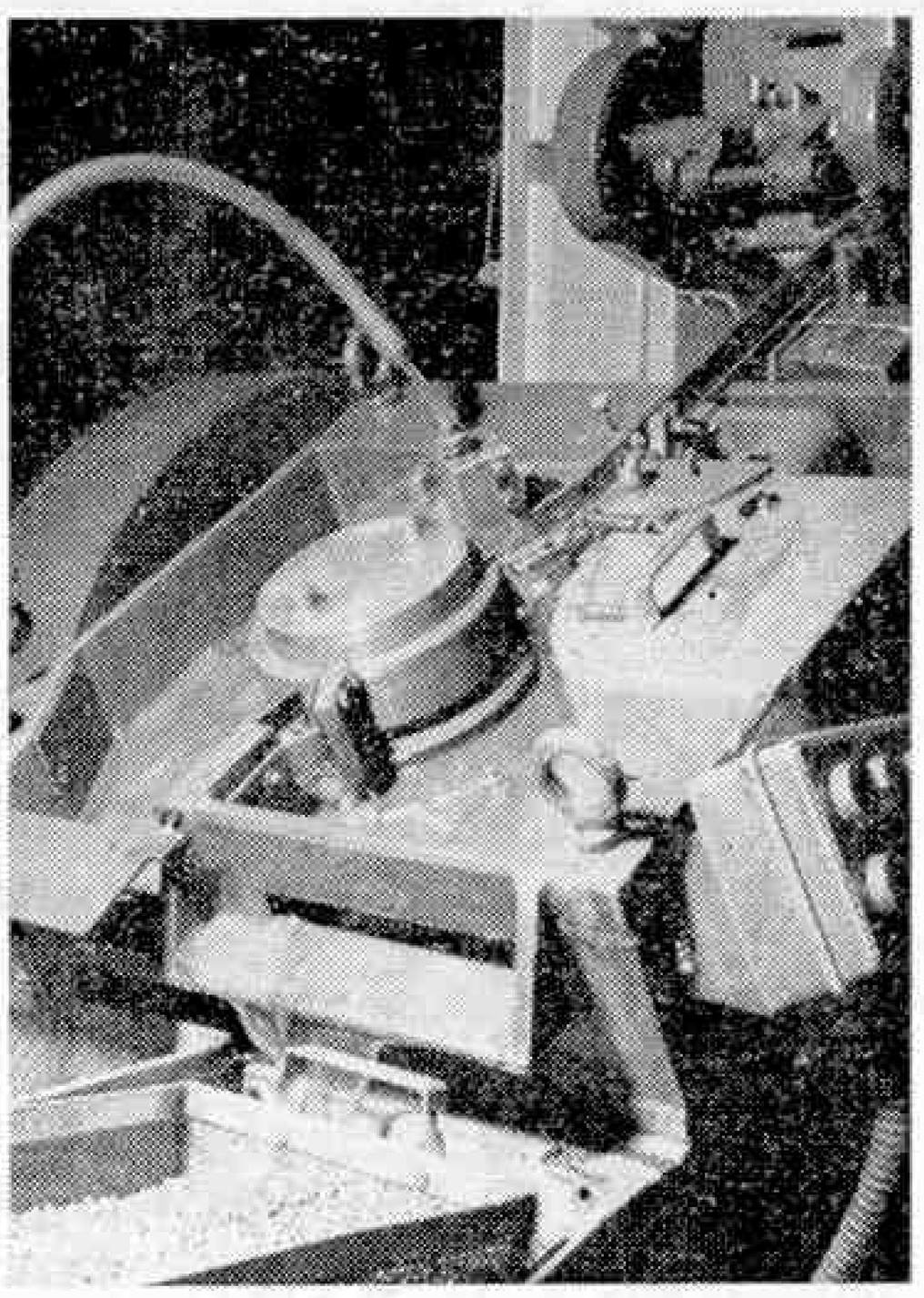




MAKING MECCANO PARTS

FOR THE craftsmen and workers who design and produce the large range of Meccano Parts, a day in the factory at Binns Road, Liverpool is a well known routine, but to the layman, a visit to the production area is quite fascinating. One tends to think of Meccano Parts as finished products in neat boxes or packets and it comes as something of a surprise to the visitor to see the state in which the raw metal arrives at the factory. It looks very far removed from the sophisticated end product; rolls of bright steel wire of exactly the right gauge for Meccano Axle Rods stand in huge piles in the stores, each one wrapped in sacking to protect the polished surface.

Even more surprising are the coils of brass from which Collars, Couplings, Bosses, Rod Sockets and Handrail Supports are made. A coil of brass 'wire' even though it is as thick as a Meccano boss, is much easier to store and to handle in the confines of a workshop than long lengths of straight brass rod but the highly specialised machinery which pours out endless streams of finished brass parts very soon 'straightens out' the coil of raw materials being fed into its hungry jaws. This is done by a series of pulleys and strainers through which the brass 'wire' is drawn over the top of the machine until ,when it reaches the 'business end' of the machine which cuts off the blanks for the bosses and Couplings etc., the 'wire' is quite straight. Axle Rods of all lengths from 1 in. up to $11\frac{1}{2}$ in. are produced on a machine which does a similar sort of thing by drawing the coil of bright steel wire through strraightening dies, situated, along the 'bed' of the machine while, at the far end, the appropriate lengths are cut off, spun and neatly rounded at either end.

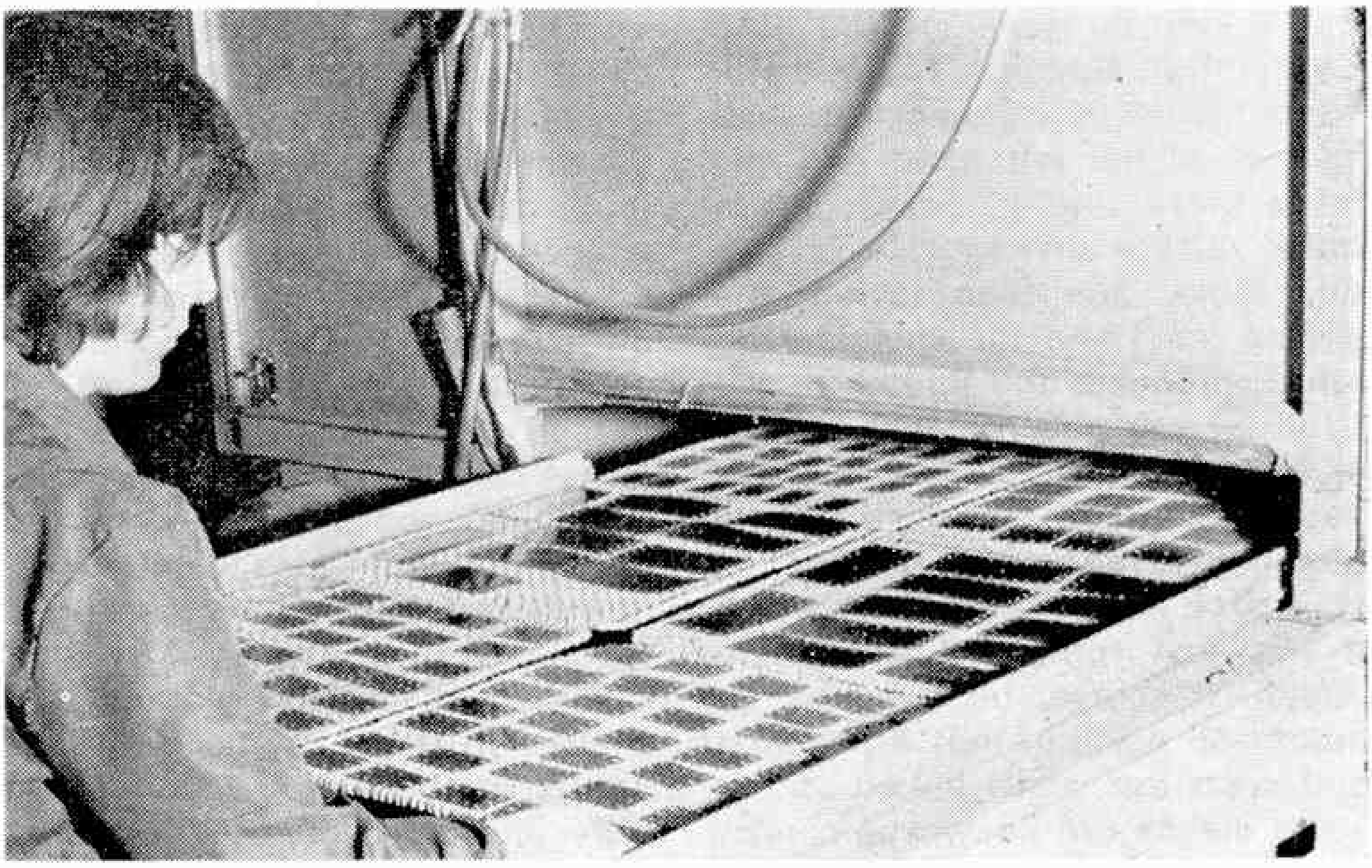
In fact the principle of feeding the machines with coils of raw material applies to a very wide range of Meccano Parts including Plates,

Strips, Girders, Angle Brackets, etc. Each different machine has an external spindle on which the coil of mild steel strip, of the correct gauge and width, is placed. The coils contain several hundred feet of steel and are very heavy, some needing mechanical handling to place them in position as they are literally a solid cylinder of steel, anything up to 2 feet or more in diameter.

Any one machine may be required to carry out a number of different operations on the blank strip being fed into its presses. The holes in Meccano parts are punched, of course, with multiple punches and all of the material has a film of mineral oil covering it to assist its easy movement through the machine and to assist lubrication of the punching tools. If we consider a part such as the $2\frac{1}{2}$ x $1\frac{1}{2}$ in. Flanged Plates, the manufacturing process is as follows: one set of round hole punches deals with the 15 holes occupying the 'top' of the plate; another set deals with the slotted holes in the flange and puts the curved corners on the still-flat material, while a third part of the press guillotines the individual plates from the continuous strip, bends up the flanges and delivers the finished stamping into a steel bin stacked with hundreds of other similar items.

One of the hardest working presses in the factory is that concerned with punching millions of holes in thousands of feet of mild steel strip which is exactly the right size for the Flat Girders. The curious thing about this machine is that it can go on making a length of Flat Girder ad infinitum, or at least until the raw material is exhausted. Quite a number of giant Flat Girders can often be seen on the floor of the factory near to this punching machine, up to six or seven feet long. They conjure up images of huge models with long legs or supports which would fill a living room in no time. The purpose of having a machine of this nature is to supply

Opposite page: left, Flat Girders in course of production; right, the thread rolling machine, which completes the production of Bolts at a phenominal rate, rolling a 5/32 in. Whitworth form thread on to notched Bolt blanks. Below: unpainted Meccano Plates being fed into one of the combined spraying machines and drying ovens.



punched strip which is then cut off by an adjacent machine to form any one of the ten lengths of Flat Girders currently produced.

To make an Angle Girder of course, it is only necessary to pass Flat Girders into a folding machine, several different lengths being required to cover the range from $1\frac{1}{2}$ in. to $24\frac{1}{2}$ in. Angle Girders. Again, this is a continuous process, the forming being done by the folding machine which, when fitted with another tool, also guillotines the Girders into correct lengths, putting the neat rounded ends on to each length at the same time.

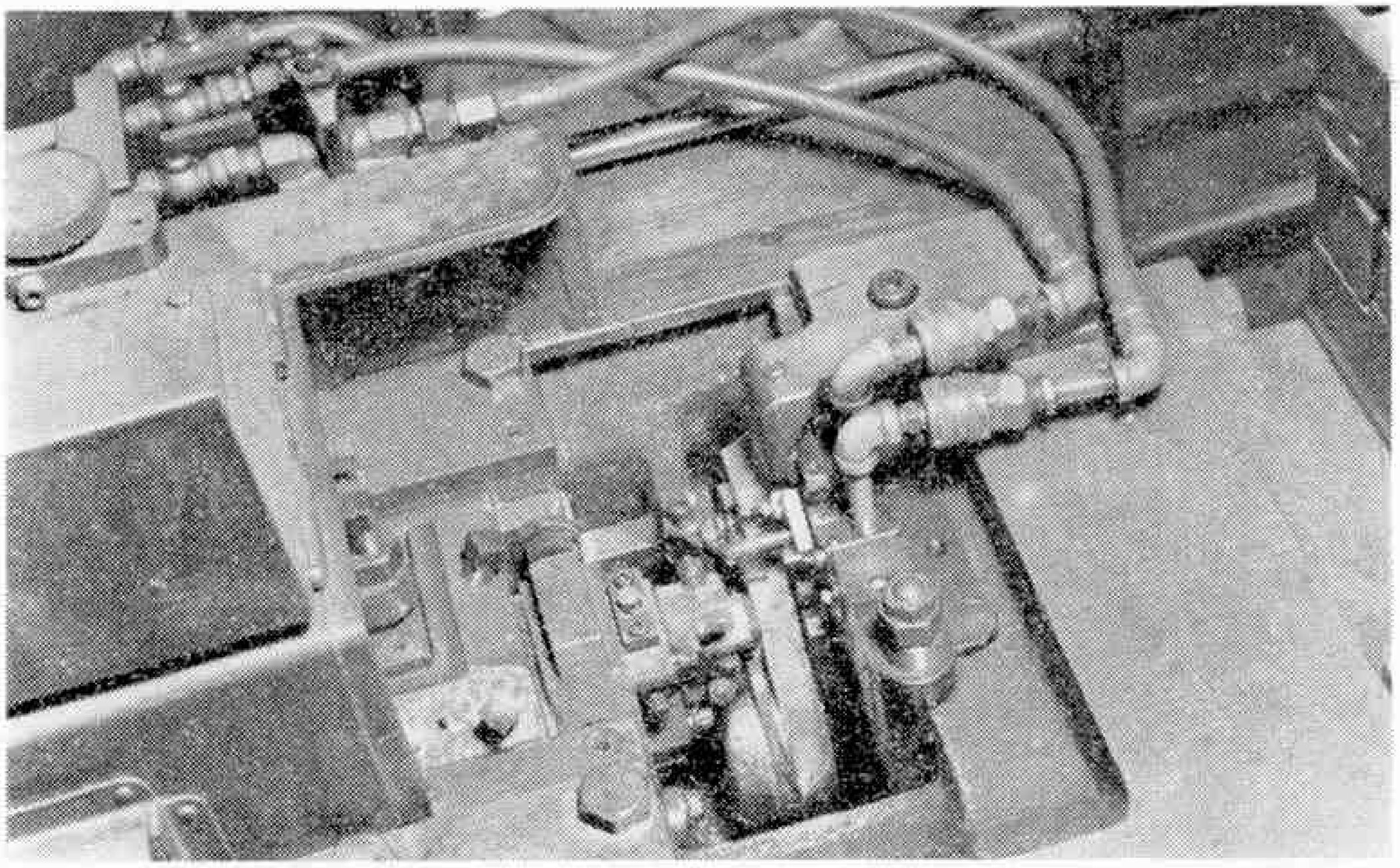
The production of Perforated Strips longer than $5\frac{1}{2}$ in. follows the same sort of continuous punching process but a thicker gauge of metal is required. Most of the machines are automatic and improvements to the production methods are introduced continuously to cope with the world-wide demand for Meccano parts.

One or two machines are relatively simple and one in particular looks rather like a modest bench drill, operated by a girl whose job it is to make the tapped thread inside the transverse bore of the Rod Socket, Part No. 179. The operator has a tray full of the almost-finished sockets at her left hand and she feeds these, one at a time, into a quick release drilling vice on the drill table. She then lowers the drilling head and the spinning tap which produces the thread for the Grub Screw cuts its way swiftly into the brass until it reaches a predetermined depth, at which stage it promptly reverses and 'screws' its way back out of the thread which it has just formed. Such a job could, of course, be done by an automatic machine but production and costs are vitally linked and at some stages the answer is a relatively simple machine tool so long as it can cope economically with the demand for a particular part.

Demand for Meccano Parts is not always a simple factor to assess. Christmas orders are always placed very early in the year and the machines work for long periods to cope with the rush of orders. As the season approaches, the accent is on packing the Outfits both for home and overseas markets and, at such a time, a number of the machines on the factory floor are not required, although those which make parts that are in continuous demand, such as nuts and bolts, axle rods, small gears etc., carry on throughout the year.

The Binns Road factory of Meccano Ltd. is never quiet, even when seasonal demands begin to ease off, as the production of Dinky Toys goes on at full tilt throughout the year and these famous models, exported all over the world, are made on the same factory floor, in close proximity to the Meccano Parts. The officials at Meccano may be in any part of the building when they are required to take a telephone call and an ingenious method of summoning staff is employed to overcome the incessant factory noise. A loudspeaker system would soon be drowned by the roar of the presses under full production, but a high pitched signal, well above the natural frequency of the factory noise is employed to summon individual officials by code. It is, in fact, a very simple code, i.e. the Morse code, a letter of the alphabet being assigned to each person on the calling list. This is the only signal that the individual needs to respond to.

Visitors to the factory are quickly aware of these signals but the officials at the factory soon learn to disregard them until their own par-



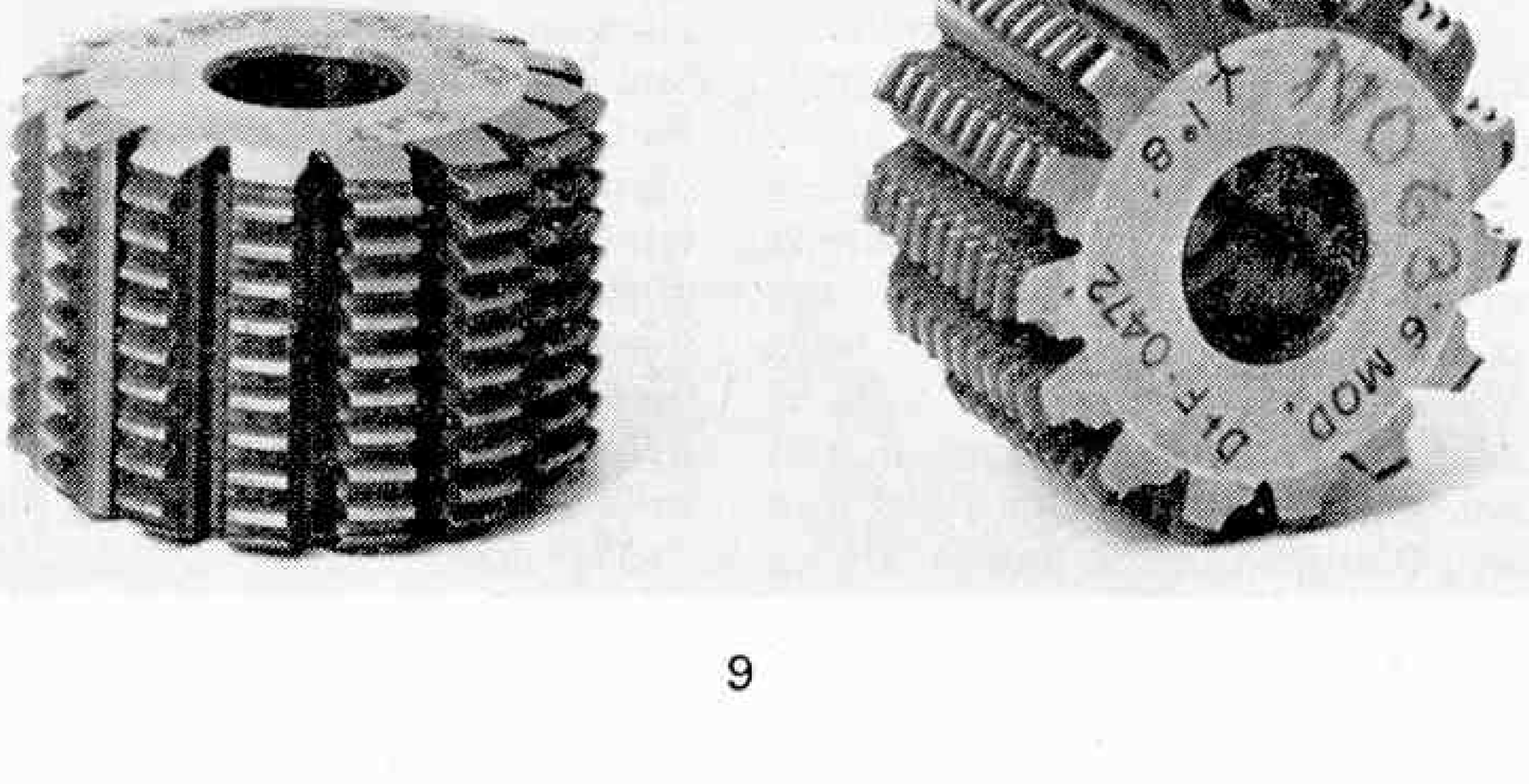
A close-up of the first machine used in the production of Meccano Bolts. A short length is cut off a coil of steel 'wire'; is correctly positioned and is then 'punched' to form the basic blank.

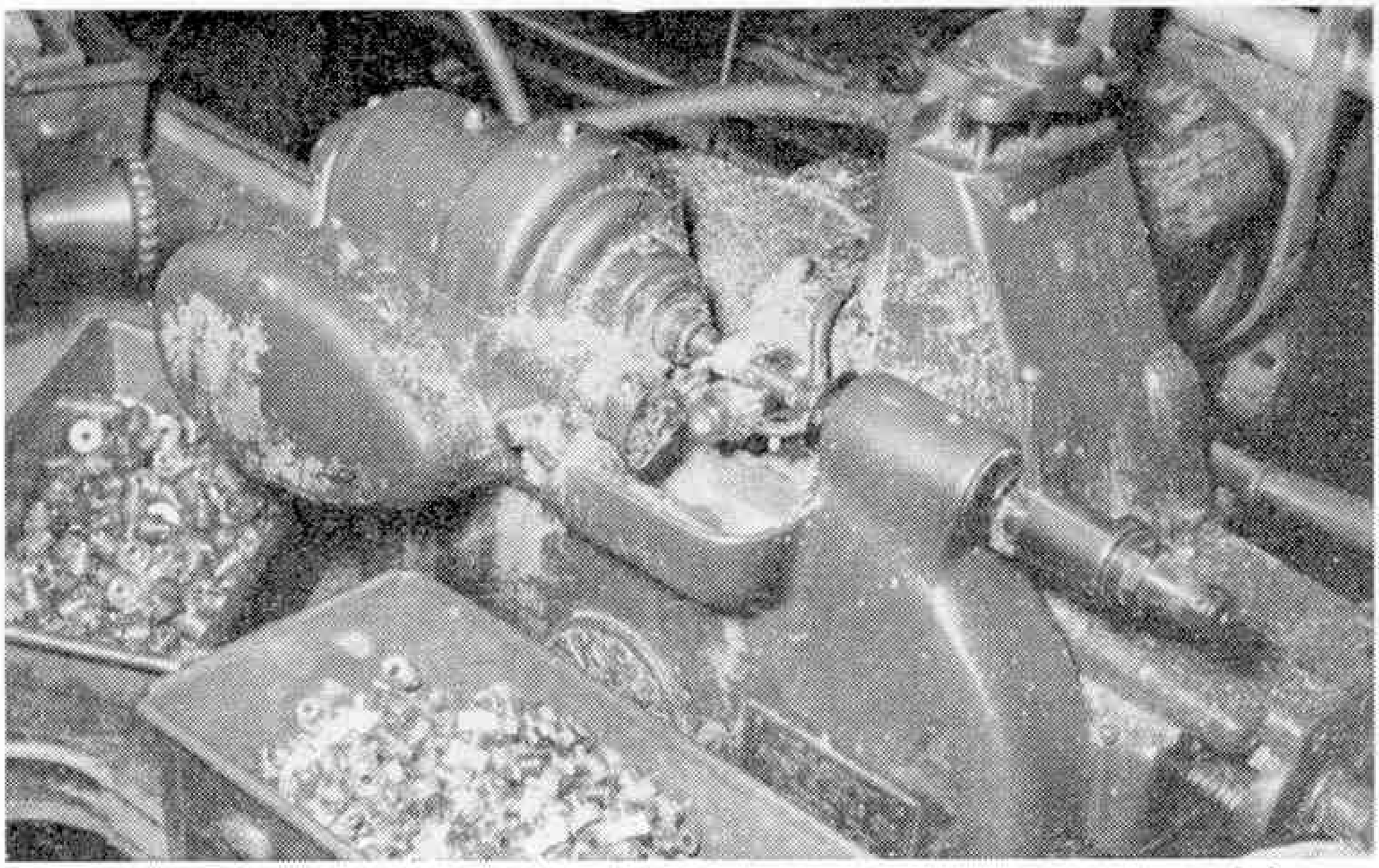
ticular call comes up!

When the presses have finished their jobs in stamping out the Meccano Parts, the Parts themselves are far from ready for the customer as they still have a film of oil on them as well as a few rough edges from the punching or cutting operation. At this stage they are loaded into barrels of sawdust in which they are tumbled for a long period. This removes most of the oil film and the tumbling motion polishes the Parts until they are smooth and bright. Those Parts which require plating or enamelling are then washed or 'pickled' to remove all final traces of foreign matter and, when they are quite clean, they go on to the finishing process.

In recent years, Meccano Ltd., have carried out considerable re-

Hobs – the tools used to cut the teeth in Meccano Gears and Pinions. Note the rows of minute cutting teeth.





One of the gear-cutting machines about to finish the job of cutting the teeth in two Meccano Pinions – a process which is fully described in this article. The hob can be seen beneath the Pinions, while plenty of brass swarf is evident.

search in the finishing of their products and, to-day, all Strips and Girders as well as several other Parts are finished in a bright zinc plating which is superior to any finish used hitherto, including the nickel plating used in the early part of the century as the zinc coating is as flexible as the steel strip on to which it is electrically deposited and so does not crack or chip in use. The factory also gives a great deal of thought to devising the best methods for producing a durable and attractive finish to the painted parts such as Flat Plates, Flexible Plates and the larger Pulley Wheels. The machines that spray these Parts cope with an enormous quantity in the course of the day and all spraying is automatic.

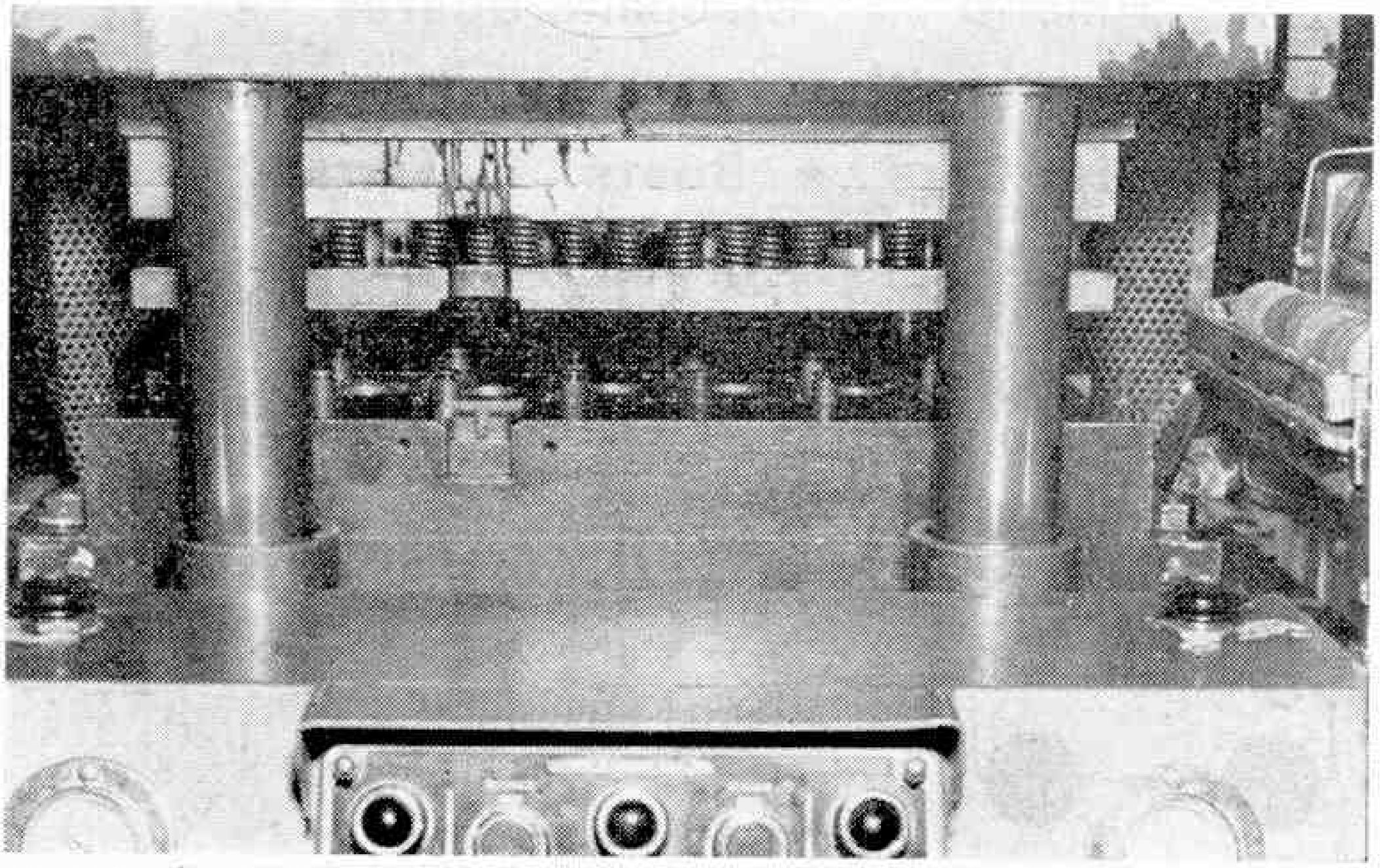
Each spraying machine is like a long closed steel box through which runs a conveyor belt wide enough to carry two or three wire trays abreast. Each of the wire trays is carefully loaded by a team of girls who place the individual Parts in a set pattern on to the tray in such a way as to make maximum use of the available space without allowing Parts to touch one another. The enamels are made up with great care to give a consistency of shade and large pails of the appropriate colour are fed into the spraying machine's tank. The loaded trays are then placed on the conveyor belt which takes them at a constant speed into the spraying compartment which is fitted with multiple jets. These run on parallel slides above the wire trays and they sweep across the width of the conveyor belt, spraying as they go. The combination of the movement of conveyor belt and jets, plus the constant spacing of the spray distance ensures that each Meccano Part receives a uniform build up of a number of thin coats of enamel which results in a hard-wearing glossy finish. As the loaded trays move out of the spraying compartment they pass through a heated oven which is thermostatically controlled and the Parts emerge dry at the far end.

At this stage, of course, only one side of the Part has been sprayed therefore they are turned over to reveal the unsprayed side. After a second run through the spraying machine, each part is then ready for inspection before packing.

Probably the most fascinating of all Meccano sights is a train of gears working smoothly in a mechanical model and the production of these Gears requires an extremely high standard of precision. Bevel Gears are cut on a very special and costly machine, the same thing applying to Helical Gears. The basic Meccano gear, however, is the Pinion, and this is a relatively simple gear to cut. In fact, it is quite a small bench machine which does the job. The Pinion blanks are turned from high quality brass bar on a capstan lathe and passed on to the person operating the tooth-cutting machine. A pair of Pinion blanks are then placed 'back to back' on a spindle the size of a Meccano Rod. Below the blanks is a high-speed revolving cutter, known as a 'hob', mounted on a shaft at right-angles to the Pinion blanks. As can be seen in the picture on page 9 the hob is roughly cylindrical in shape and consists of several rows of minute cutting 'teeth', each one slightly larger than the other. In operation the machine feeds the hob, on a slide, into the lower edge of the Pinion blanks and, as soon as the cutting teeth bite into the brass, the blanks spin slowly round so that the first tooth makes a series of tiny cuts in the brass around the full circumference of the blanks. As the hob moves on to make another series of cuts adjoining the first, the next, larger, tooth deepens the first cuts the next tooth making the cuts even deeper, and so on until the Pinion is finished. Since the pitch of Meccano gears is constant, the same machine can of course be set up for Pinions of different diameters and face-widths.

When you think about it, this machine is really amazing. Bearing

A large, fully-automatic press used in the production of such parts as Flanged Plates, etc The stamping tool is, in effect, 3-tools-in-one, the first part producing the round holes in the Plate, the second part producing the elongated holes, and the third part cutting the Plate out of the roll of raw material and bending up the flanges.



in mind that the hob is spinning *at right-angles* to the Pinion blank and that each tooth makes only a minute cut in the blank while it *is* spinning, the synchronisation of the machine must be fantastically accurate to get the right cutting tooth in the right spot at the right time so as to result in completed Pinions with rows of perfectly-shaped, parallel teeth!

Finally, the items which hold the whole system together, namely Nuts and Bolts, are produced by the million on ultra high-speed machines. In the case of the Nuts, one machine first stamps out the familiar 'square' from mild steel at a prodigious rate, then, after the blanks have been barrelled for several hours to remove all sharp edges, they are transferred to the tapping machine which taps (threads) them at the rate of 200 a minute.

Turning to the Bolts, three individual processes are used in their manufacture, one machine first producing the basic headed blanks from coils of steel wire. The blanks are next fed into the hopper of a second machine which notches the heads, then, from there, the partially-finished items enter a final machine which rolls them between two parallel dies to form a perfect thread of 5/32 in. British Standard Whitworth. The phenomenal quantity of one million standard-length Bolts are produced every week and, to give you some idea of just how many this is, if Meccano Limited were able to make only one Bolt per day, then they would need to have started in 772 B.C. to finish this year a quantity which in actual fact they make in one week!

Every product which leaves the Meccano factory carries the Meccano Guarantee of quality and reliability. After a visit to the factory and an inspection of the machines that make the parts and the raw material that is used, the reasons for the long life and popularity of Meccano for more than half a century are plain to see.

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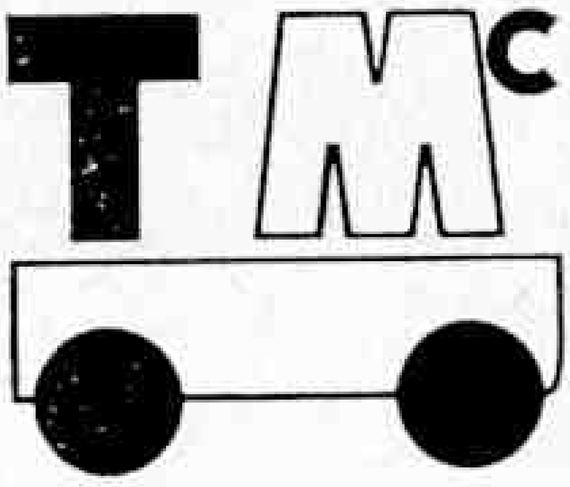

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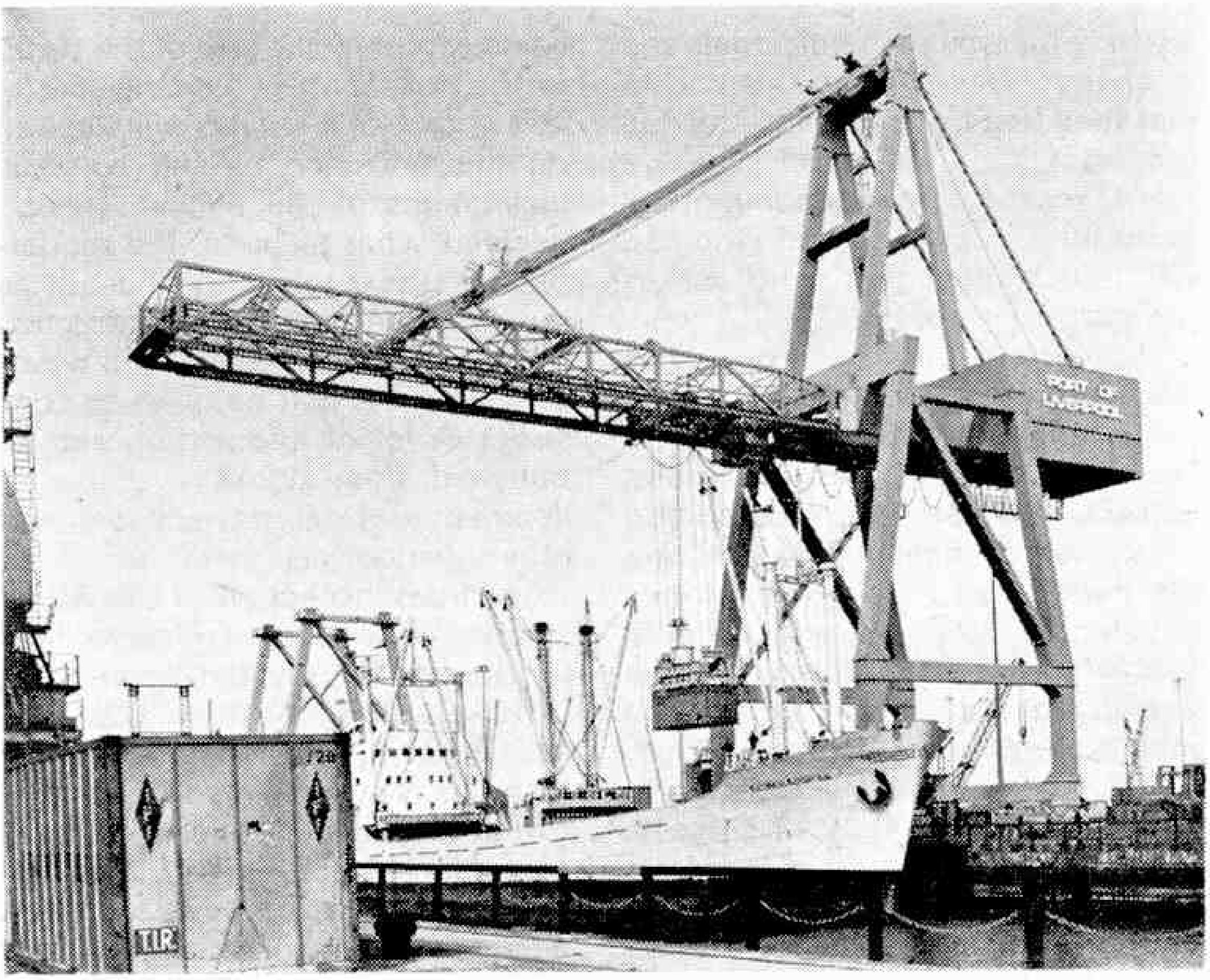
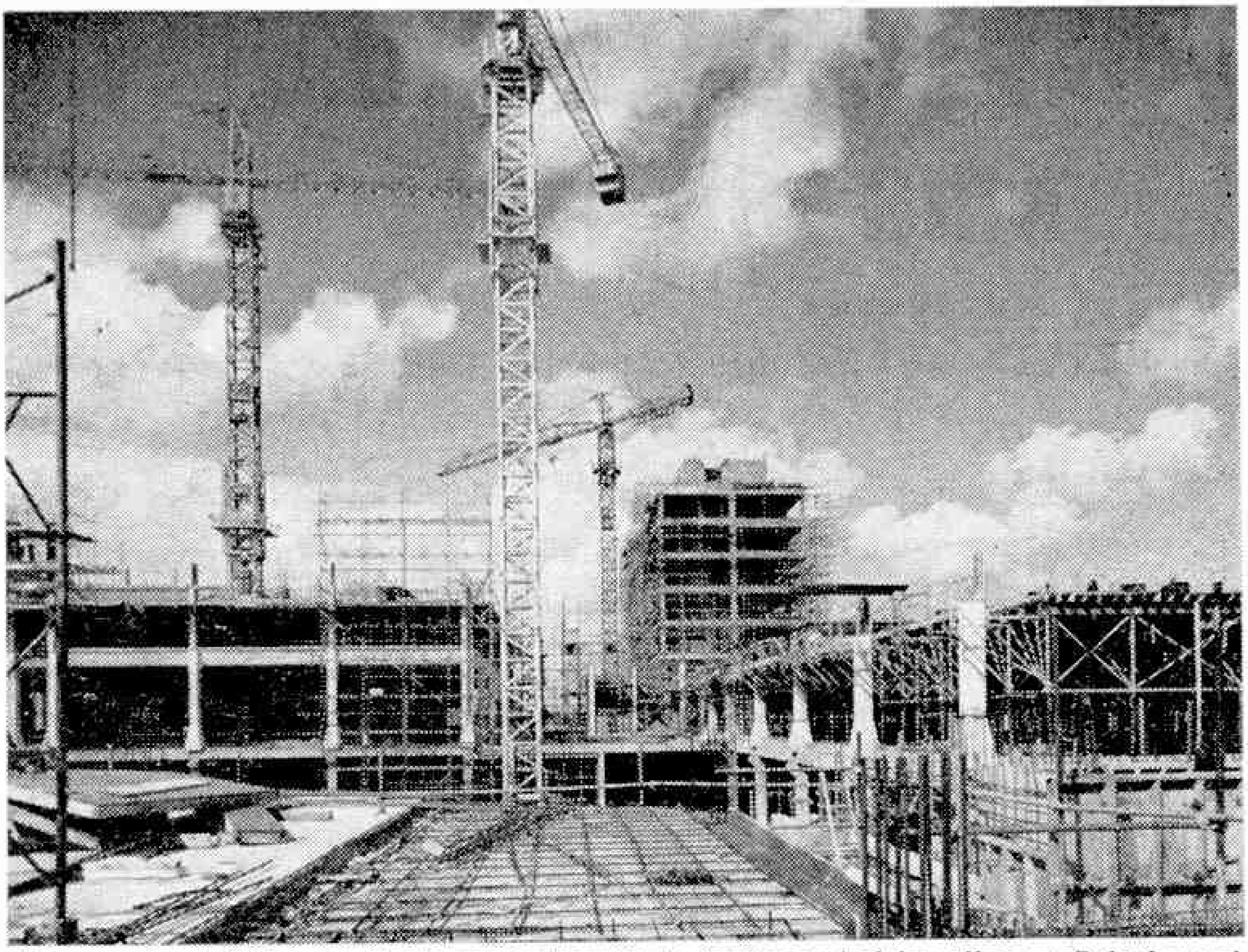
WHAT SHALL I BUILD NEXT ? LOOKING FOR NEW SUBJECTS

by Norman G. Tudor

KEEN MECCANO model-builders do not rest content for very long with building only the models shown in the Instructions Book provided with their Outfits. Once they have learned the knack of fitting the various Parts together and have discovered, by building the Instructions Book models, some of the unlimited possibilities provided by combining the Parts in various ways, they begin to realise the enormous scope which the Meccano system presents for reproducing almost any type of mechanical structure or mechanism. As a consequence they are fired with the desire to strike out

Ideas for new Meccano models are everywhere, but for those living near a port, dockland is a particularly rich source of inspiration. This picture shows only a tiny part of one of Liverpool's docks yet, if you look carefully, you will be able to see at least five possible subjects to model. (Photo reproduced by courtesy of the Mersey Docks and Harbour Board.)



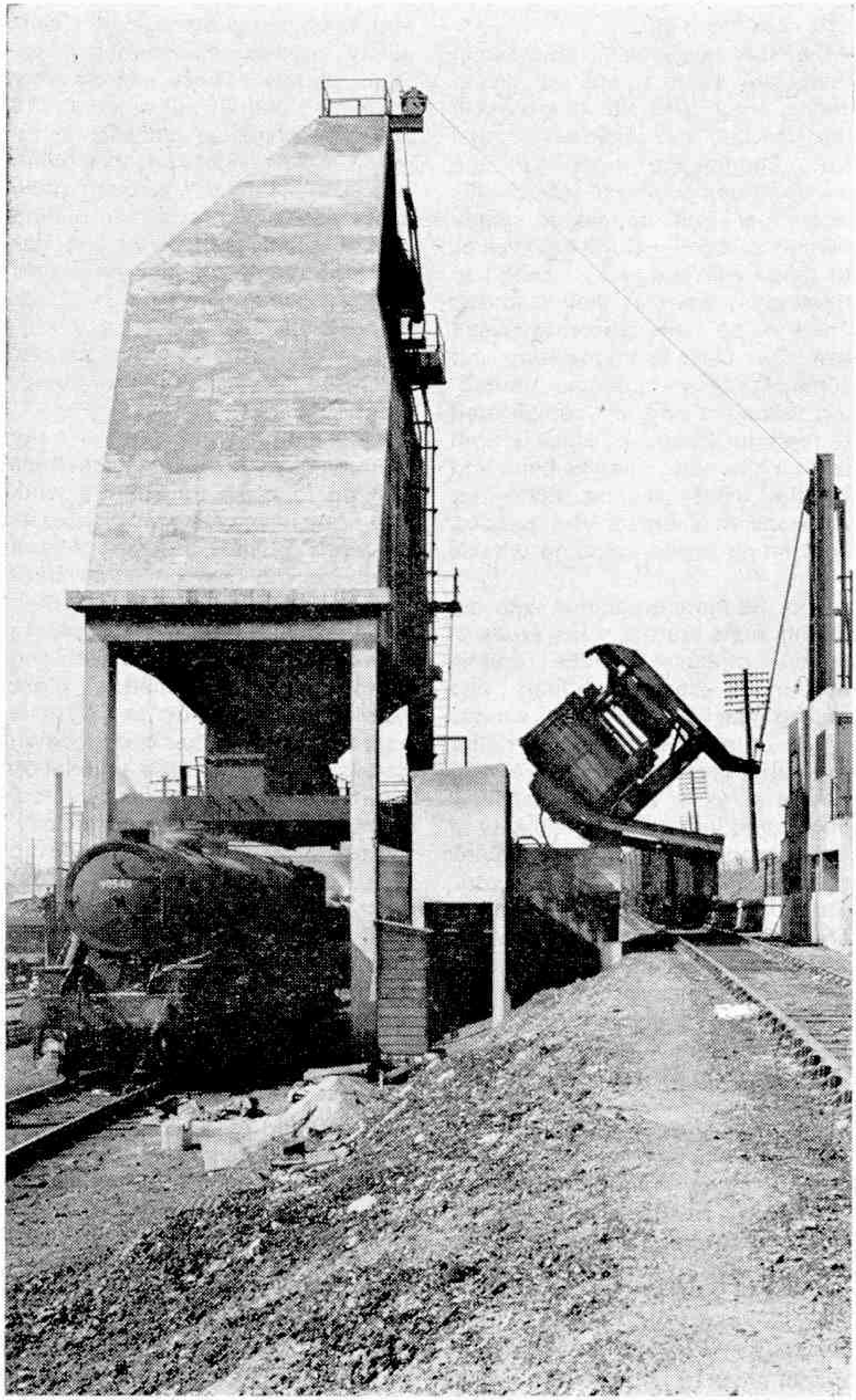


Above: vast building projects are underway in towns and cities all over Britain and building sites are further valuable sources of inspiration for the Meccano enthusiast. Right: any number of useful subjects can be found on our railway network. No less than three are shown in this photograph: a coaling stage, a locomotive and a goods wagon.

into designing their own models and it is when they start on this course that they begin to realise to the full the fascination, fun and pleasure that Meccano model-building offers to an intelligent boy. And who can fail to be intelligent who makes Meccano his hobby!

Apart from the 'kick' one gets from making models to one's own ideas, there is the great fun of searching for novel and interesting subjects; the fascination of planning how it will be built and of selecting the Parts to be used in the various details and ultimately the pride of achievement when the model is completed and set in motion by means of a power unit of some kind.

Every owner of a Meccano Outfit knows that the variety of subjects that can be reproduced in Meccano is practically unlimited, but of course the range is controlled to some extent by the size of the Outfit or the collection of Parts available. The choice of a subject will depend on this and also on the personal inclinations of the builder. Having decided what to build, the model-builder's next job is to find out as much as he can about the actual machine, bridge, vehicle or whatever else it is that he plans to construct. A lot of information can be obtained from books available in libraries or from newspapers and other periodicals, and in many cases from inspection of the actual subject. One very extensive field for models is provided by vehicles in which category numerous subjects other than cars and lorries are featured. Old-time horse-drawn carriages, stage coaches, constructional equipment such as bull-dozers, mobile cranes, excavators and hinch diggers are just some of the things



that come to mind.

For the very small Outfit owner there are such things as sedan chairs, pony carts, simple locos like the 'Rocket' and children's pedal cars. Engineering workshops are another good source of model subjects that will appeal to many owners of smaller Outfits as well as to those who are lucky enough to have many Parts at their disposal. There are so many different types of machines used in engineering and some of them are extremely interesting without being too complicated to reproduce fairly realistically from quite a few parts, such as band and circular saws, drilling machines, mechanical hammers and presses, light lifting tackle, grinding wheels etc.

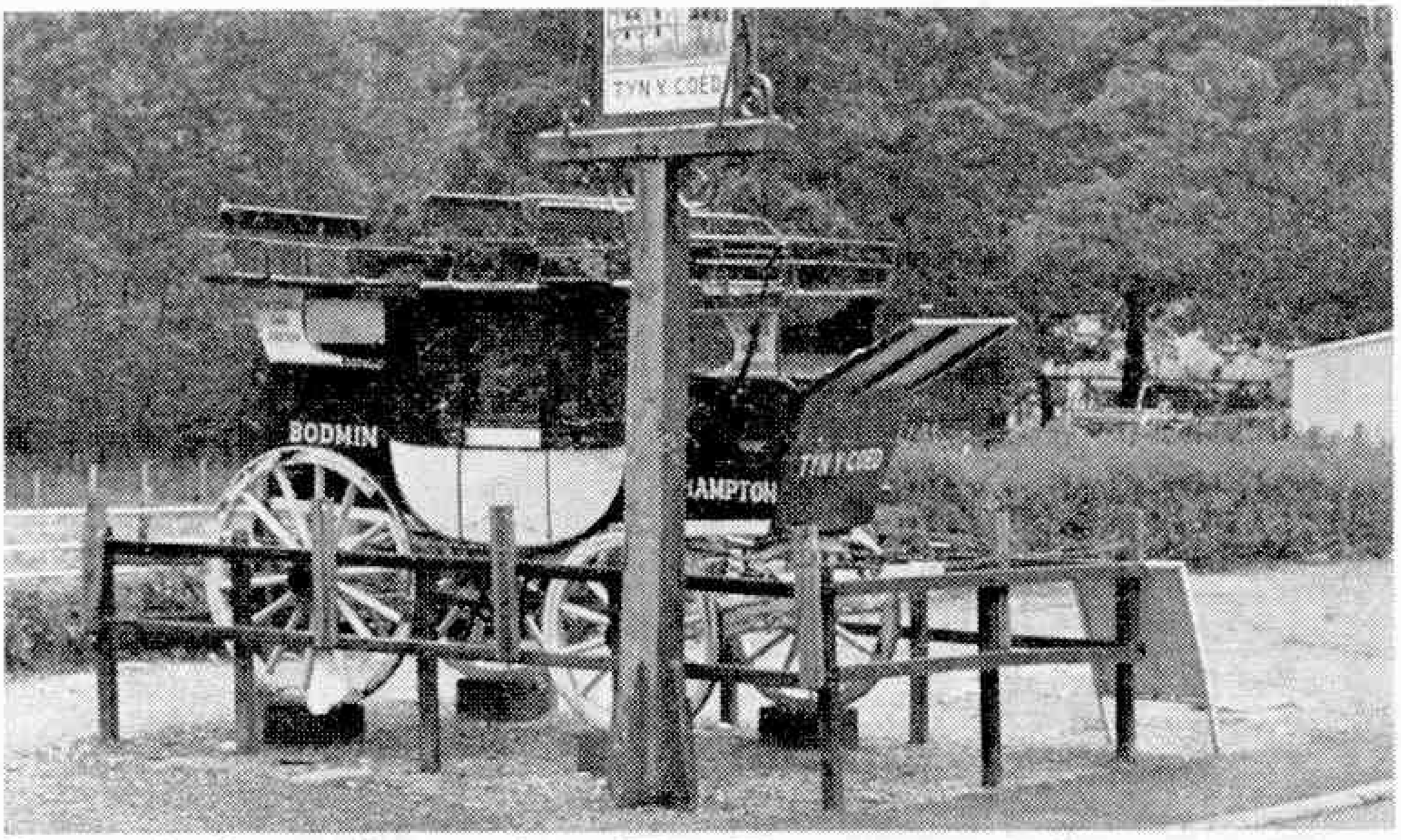
For the more ambitious with big Outfits there are the many types of lathes, multiple spindle drilling machines, planing, boring and milling machines and the various types of overhead gantry cranes. It is quite easy to find pictures and details of all of these in any local library and indeed there is plenty of scope in some areas for seeing many of these machines actually at work. Then there are the various ancillary equipment found in many workshops, which include mechanical trucks used for moving parts about the shop and the fork lifting trucks designed for picking up, transporting and lifting the parts so that they can be stacked in the stores.

Indeed, ideas for new models are everywhere to be found by the really keen observer. Perhaps he is going on holiday to the seaside, for example, or to spend a few days in the country. If he takes a small notebook and pencil with him on his rambles, and keeps his eyes open he should be able to jot down dozens of ideas for models that he can construct on his return home. What about constructing a few 'simplicity' models representing Meccano 'people'. These can be very amusing if skilfully put together and there are plenty of subjects to be found at the seaside: a man riding a donkey, a beach photographer, a surf board rider, or a man pulling an ice cream cart. Skilful arrangement of the head, legs and arms of the figures can give a quite humorous appearance and a collection of such 'Meccano people' will also provide fun for one's friends.

On the other hand, if one is in the country, many of the things one sees that go to make up country work and life can provide good subjects for models. There are various farm machines such as cultivators, tractors, the machines used for turning hay for drying, harrows and potato lifters all of which can be seen and often can be examined at close quarters in farmyards so that it is easy to make sketches and jot down details on which to base a model on returning home. In the country, too, there is scope for many 'simplicity' models of human figures made up from a few Strips, Pulleys (for heads) and Angle Brackets: the farmer feeding his pigs, while his wife scatters corn from her basket to the chickens, or the farm hand sharpening his axe on an old type treadle grindstone in the farmyard, all can feature in a collection of such figures.

One could go on for a long time suggesting ways and means of seeking out subjects for models but I must content myself with just a brief mention of one or two other sources and then leave the model-builder to carry on for himself.

It occurs to me, for example, living as I do near a large Port, what a wonderful opportunity this Port provides whenever I need inspira-



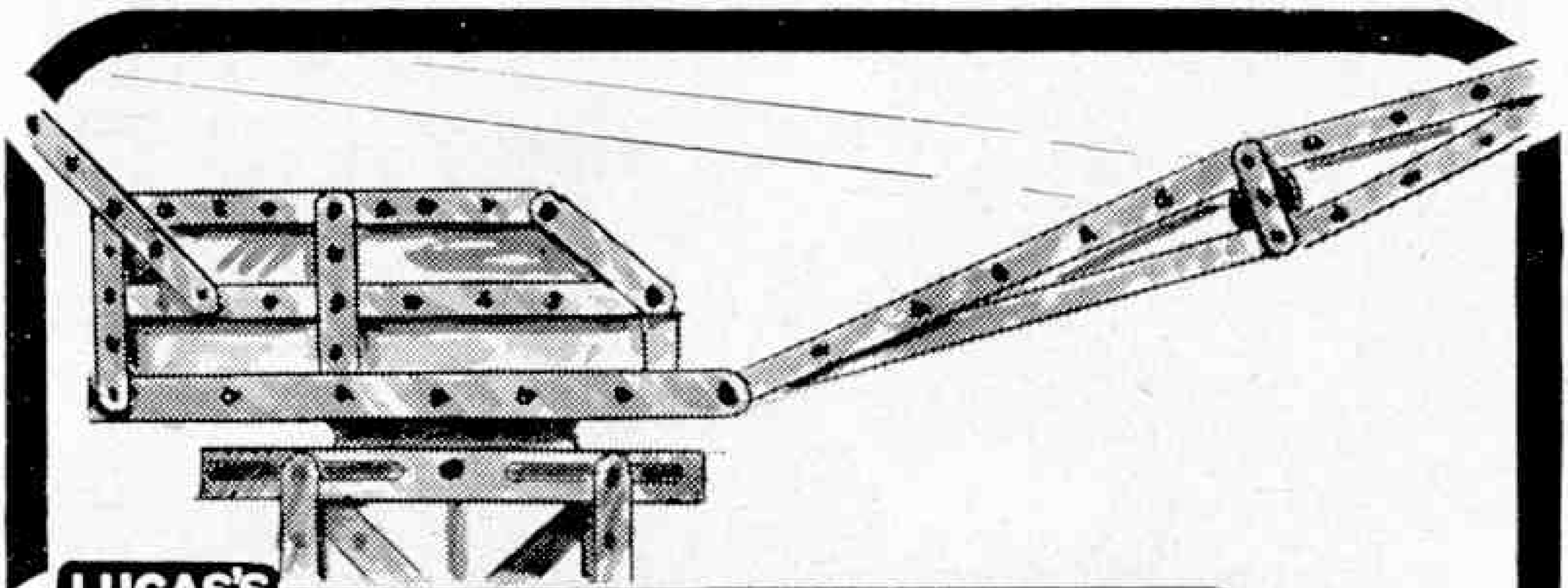
Country dwellers need not go short of ideas. There are no end of interesting subjects about – if you look for them – such as this old stage coach displayed at Capel Curig in North Wales.

tion for an interesting new model. A walk through dockland never fails to suggest at least one or two ideas that can be turned into attractive models, but it is a field that can best be exploited by those with really big Outfits at their disposal. Ships, of course, provide the main subjects of any port and at the larger ones many types of vessels can be seen giving excellent opportunities of gaining sound information about the design of ships engaged in various trades and the peculiarities of their construction. Such knowledge gained in the course of a stroll through dockland will be very useful when designing model ships later-on to one's own ideas.

Apart from ships, other ideas are provided by the cranes, crating plants and the fussy little locomotives that are to be seen running along the quay sides at some docks. So if you are lucky enough to live within easy distance of a Port, go along some day provided with your note book and pencil and I am sure you will return home with lots of ideas and bursting with enthusiasm to get to work on a new model as soon as possible.

Finally, even a walk in one's own locality can be very rewarding to a Meccano enthusiast on the look-out for a subject for his next model. These days there is great activity in road-making and repairing, entailing the laying of gas, water and electricity mains. Wherever these operations are carried on, mechanical equipment suitable for modelling in Meccano is to be seen at work, some complicated and some much less so, making it possible to find subjects suitable for both large and small Outfits.

It will be seen, therefore, that, quite apart from the fact that motor vehicles and cranes are generally regarded as the most popular of all subjects for Meccano models, there is a tremendous range of other subjects that are equally fascinating and fun-providing and which can be reproduced just as realistically. So keep your eyes open whenever you go out and you will never be short of ideas for that thrilling next model!



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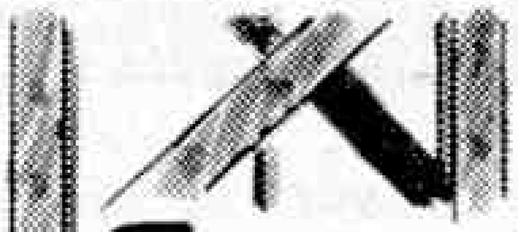

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GENERAL HINTS ON MODEL BUILDING

by B. N. Love

IT IS perfectly true to say that we can all learn something new every day and this well-known maxim is very much the case with owners of Meccano Sets, be they young or old. The amazing versatility of the Meccano system, and its endless possibilities, gives them the first medium in the world for mechanical experiment, but, for the newcomer to the hobby, there are several basic things to learn before advancing into experimentation.

The instruction manuals issued with the outfits contain 'exploded' views of all the models featured so that the constructor can see at a glance whether any particular model is simple or complex. Beginners should attempt the simpler models at the outset to get the 'feel' of the Parts and to learn their Part Numbers and descriptions. The name given to each part is either self-evident – such as Strips, Axle Rods, etc. – or is derived from well-known engineering terms such as girder, coupling etc.

All model builders are familiar with the Spanner, Part No. 34 and the Screwdriver, Part No. 36 but it is not always realised that there are at least three other Meccano tools which are sometimes unfamiliar to the owners of smaller Outfits. The tools in question are as follows: Part No. 36a, Long Screwdriver, Part No. 34b, Box Spanner and Part No. 36c, Drift. The Long Screwdriver had a blade which is the same size as a Meccano Axle Rod and so it will pass through holes in the sides of Flanged Plates and other Meccano assemblies to engage the head of an internal Bolt which might otherwise be impossible to reach with the standard Screwdriver because of its broader blade.

While the use of Spanner and Screwdriver becomes second nature to the modeller there is still a right and wrong way of using them. If possible, the Nut should always be held steady while the Bolt is tightened by the Screwdriver as any attempt to put leverage on the Nut will produce a circular score on the enamel surface of the Meccano Parts. This enamel is hard-wearing in general handling but will not accept abuses of this nature. Care in the use of the Screwdriver is also called for or damaged boltheads will occur. See that the edge of the Screwdriver blade is a good fit inside the slot in the bolthead and *never* sharpen the blade to a chisel or tapered point. The end of a Screwdriver blade should always be quite blunt and squared off to be a good fit in the bottom of the slot. A sharp screwdriver is a very dangerous tool and it will always tend to ride up inside the slot of the bolthead causing damage to the bolthead if not an injury to the model-builder himself.

There are occasions when a particularly strong hold is required from Nuts and Bolts surrounding a rotating or vibrating mechanism and the extra grip can be provided by

placing Meccano Washers under the boltheads and the Nuts. The Spanner can then be employed to put extra purchase or tension on the Nuts ensuring a very firm hold. If absolute rigidity is required in a model running for long periods, an extra Nut can be placed on the Bolt; the first Nut, which has previously been tightened, is held by a Spanner, a second Spanner being used to tighten the second Nut against the first one. This is called 'lock-nutting'.

Meccano Bolts are produced in five sizes from 7/32 in. up to $1\frac{1}{8}$ in. and these are adequate for structures where several Strips or Plates plus Washers and lock-nuts are placed together. In exceptional cases it is possible to extend the properties of the Nuts and Bolts by using Screwed Rods which are available up to $11\frac{1}{2}$ in. in length. The Box Spanner has the advantage of cup-shaped ends which can be used to hold a Nut while passing it through or under a Meccano model into small spaces that fingers cannot reach or enter. Both Meccano Spanners are cranked at one end to permit them to be used in awkward corners. It is important to remember that the correct use of Nuts and Bolts is essential in Meccano model-building as care at this stage can mean the difference between a model which looks good and works well for long periods and one which looks sloppy and falls apart in a very short time.

We come now to the Meccano Drift – a very useful tool indeed and one which no serious modeller should be without. At first sight the Drift could be confused with a 4 in. Meccano Axle Rod as both are similar in diameter and length, but on closer inspection it can be seen that the Drift has one end tapered to a point. Its purpose is to bring the holes of overlapping Strips or Plates into correct alignment when a model is progressing to a stage where it is becoming a little awkward to handle. The versatility of a Drift is greatly improved by pressing a Spring Clip on to the 'blunt' end. If the Drift is then pushed through the Plates or Strips to be lined up, it will stay in position even if the model is placed on its side. The length of the Drift enables it to be thrust right through any gear box or other mechanism with a framework-width of anything up to $3\frac{1}{2}$ in., thus allowing any intermediate Strips or Plates acting as journals in the middle of the gearbox to be brought into line with the holes in the side-plates.

Additional Drifts are very valuable in this particular alignment work and, at this stage, some of the Nuts and Bolts should be left slightly loose so that adjustments can be made. Once a Drift has been used to locate a row of holes in line it can be withdrawn and replaced by a standard Axle Rod, also fitted with a Spring Clip, to maintain the alignment while the Drift is used 'further up the line'. Nuts and Bolts can then be tightened when all the alignment is complete, taking care to see that the Drifts or Axle Rods revolve freely and that there is no binding after the last Nut has been tightened

Many Meccano Parts have slotted holes in them to allow the builder latitude in making standard parts 'reach' diagonally where cross-bracing is required in general frameworks, etc. When a balanced or symmetrical structure is to be built, however, the slotted holes, particularly in Flat or Angle Girders, will have to be equalised all round either by sticking to the use of one end or the middle of the slot in opposite members of the structure. The slotted holes also allow for the

extra thickness of material in joints where such parts as Flanged Plates or the end of Angle Girders are bolted into an existing framework of Girders.

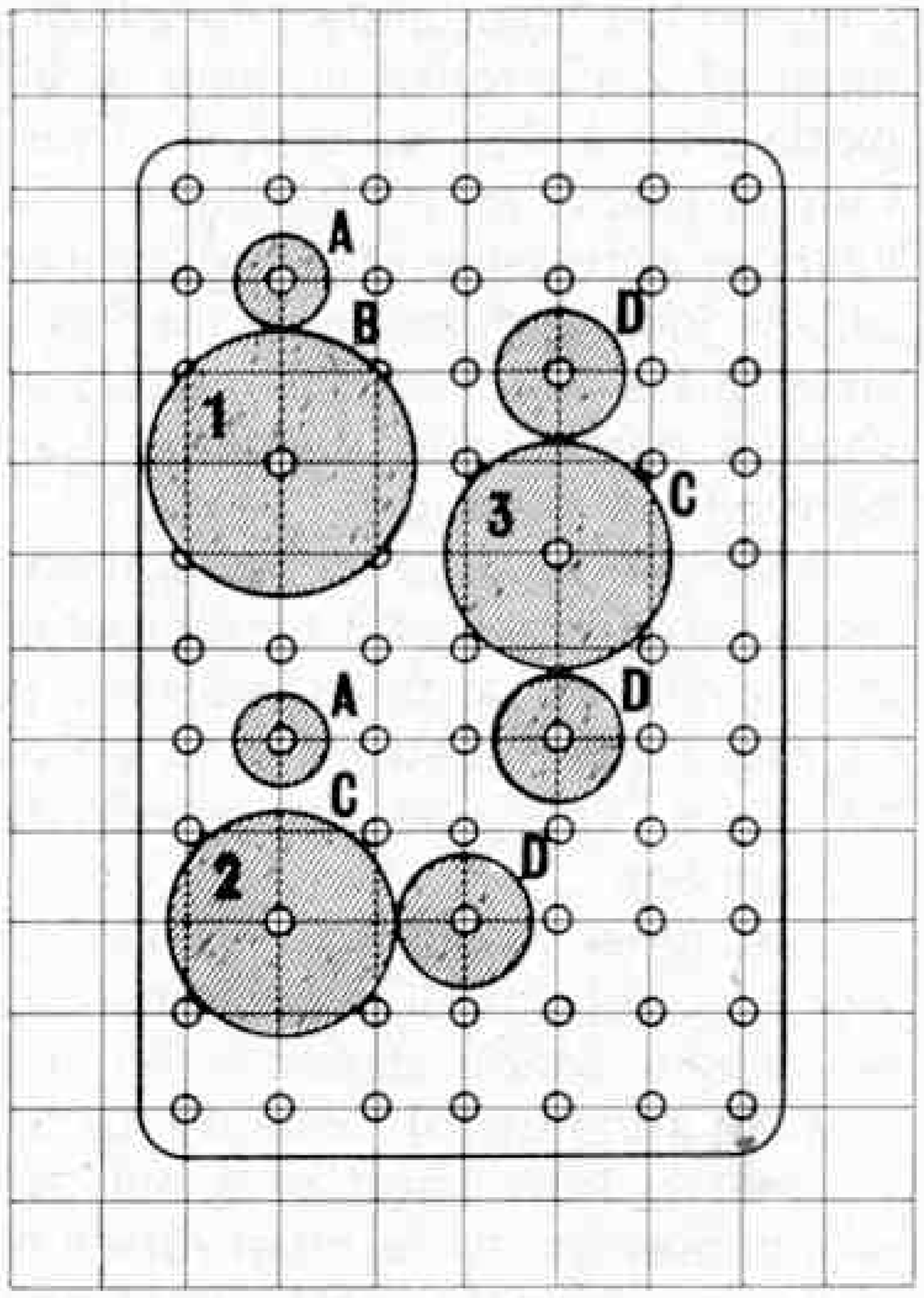
There are some occasions when a standard-length Strip is not long enough to make a diagonal join across a model, and in such cases, the Strip can be lengthened by bolting on suitable overlapping Strips. It can happen even with this method, however, that the built-up Strip either falls just short of, or just overshoots available anchoring points and to overcome this problem, two special Strips, Part No. 55 and Part No. 53a are provided with long slots of 1 in, and $\frac{1}{2}$ in. lengths respectively to facilitate the odd lengths required.

A search of an illustrated list of Meccano parts will quickly disclose that some 50 categories of Meccano parts carry slotted holes, including Angle Brackets, large Gear Wheels, Flanged Plates, Face Plates, Gear Rings, Ball-race Flanges, Hub Discs, Triangular Plates, Cranks and many others. If the different sizes of Girders, Flexible and Plastic Plates and Triangular Flexible Plates are taken into account, the slotted pieces number well over one hundred! Advanced model-builders make excellent use of this spacing latitude to accommodate differences required in getting non-standard meshing between gears required to give special ratios which otherwise would not engage with standard hole-spacing.

Whenever a model has to be finished with an external cladding of Flexible Plates, the slotted holes are most helpful in enabling a smooth surface to be produced, especially where internal or external curvature demands non-standard spacing of overlapping holes. One pair of Flexible Plates joined by their slotted holes allows an adjustment of a quarter of an inch to be made after a Bolt is inserted. Thus, four of them can be formed into a cylinder with an overall adjustment of one inch and, as there are many sizes of Flexible Plates, cylinders of various depths and diameters can be very well produced.

A simple method of strengthening a slotted joint and of improving its appearance at the same time is to use a Perforated Strip to cover the joint. This will not affect its adjustment.

The most fascinating aspect of any Meccano model is action, and successful action depends on the smooth running of working parts, no matter how large or small the model may be. Axles must run truly with no binding and whenever shafts are running in Meccano journals they should be lightly lubricated with just a tiny drop of light machine oil at each bearing point. Where Gears or Collars are running against the side of a journal, a Meccano Washer should always be inserted if space permits, to facilitate smooth running. Also, it is advisable to fit double Grub Screws to Gears on shafts carrying heavy drives for such things as winding drums and travelling motions, etc., and, if a really strong non-slip drive is required, the 4 in. Rod with Keyway can be employed. This is primarily designed for use with Part 231, Key Bolt to allow a Gear to slide along a shaft to engage with another Gear, but it can be used to give a strong non-slip drive by 'backing up' the Key Bolt in one side of the boss with a Set Screw or Grub Screw to lock the Gear in position. As this shaft has the keyway cut throughout its entire length it is better to mount it in substantial bearings such as the bosses of Double Arm Cranks or several Strips



bolted together.

On a different subject, hoisting cord in cranes can be secured to a simple winding shaft by the Anchoring Spring for Cord, Part No. 176 but, if Bush Wheels are used as end cheeks on the winding spindle, then a simple knotted hitch round the spindle with enough 'tail' left over to tie through the holes of the Bush Wheel will ensure a positive anchoring and a smooth wind-on of cord. Larger winding drums can be made very efficiently from Chimney Adaptors, Part 164, mounted inside the flanges of $\frac{3}{4}$ in. Flanged Wheels, or $2\frac{1}{2}$ in. Cylinders, Part 216, mounted outside the flanges of $1\frac{1}{8}$ in. Flanged Wheels.

Younger readers equipped with one of the smaller sets and wishing to expand will find one of Meccano's 'special' outfits such as the Gears Set or the Mechanisms Outfit are just the thing for that 'extra' Christmas or birthday present as they open up the field for bigger and better Meccano models. Manuals are included with both of these Outfits but the keen model-builder will always experiment with ideas of his own. All good engineers are capable of making sketches of their ideas and at one time, Meccano Ltd. issued a pocket sketch book for the young Meccano Engineer in which to make notes for possible models. This is no longer available but a rather better system, which makes use of half-inch squared paper is illustrated on this page. Ruled paper of this nature is on sale in bookshops catering for schoolchildren or students and it has the great advantage of conforming to the full scale of the Meccano system as a whole which is based on a standard $\frac{1}{2}$ in. spacing. Armed with such a square ruled pad and an illustrated list of parts, free from any Meccano dealer, a Meccano boy can make his own designs without having to waste time in building prototypes which might not work from the outset because proportions and gear arrangements were not carefully thought out.

The drawing on this page illustrates some simple arrangements of Pinions and Gear Wheels which are quickly drawn on the squared paper with a pair of compasses, dimensions being taken directly from the list of parts. The drawing also shows a $3\frac{1}{2}$ x $5\frac{1}{2}$ in. Flat Plate which may be used as a 'stencil' if the reader has only plain paper at his disposal. Pinion A, which is $\frac{1}{2}$ in. in diameter, will mesh with Gear Wheel B, $1\frac{1}{2}$ in. diameter because the sum of the diameters – 2 in., is exactly right for standard spacing as shown in gear arrangement 1. In arrangement 2, Pinion A will not mesh with Gear C at standard spacing since Gear C is only $1\frac{1}{4}$ in. in dia. The correct Pinion is D, $\frac{3}{4}$ in. in diameter.

Arrangement 3 shows how a drive from the top Pinion D can be transmitted to the bottom Pinion D

by the intermediate Gear C. This is a useful set-up where two shafts spaced 5 holes apart are required to rotate in the same direction at the same speed. This can be done by different combinations of course and by making use of diagonal holes, readers will find by using their squared paper that several unusual gear arrangements can be made. Larger sheets of squared paper enable the modeller to design sections of quite large structures before embarking upon the actual construction. A sheet of paper is, of course, much more portable than a Meccano Set and you can always take your paper on holiday although you cannot always take your Meccano Outfit! Squared-paper Meccano designing then becomes an entertaining pastime when our notorious weather drives the holidaymaker indoors. Those readers waiting until December 25th for new Meccano Outfits can already make a start by the methods outlined.

Meccano modellers, young or old, should get into the habit of studying Meccano parts with a view to realising that there are dozens of different ways of utilising them apart from the obvious ones. The successful modellers of the past, who have achieved great realism of detail and accurate reproduction of prototype design, have done so by exploiting the versatility of the individual Parts and the unlimited scope of the system as a whole. Above all, be neat in your work, keep your pieces clean and pack them away carefully. Don't be afraid to use paper, rubber bands and a duster when putting your Outfit away. In return, it will give you faithful service for a lifetime.

LAWSONS

71 NEW GEORGE STREET

PLYMOUTH

MECCANO SETS AND PARTS

CHEMISTRY SETS
CARPENTRY SETS
CONSTRUCTION KITS
STEAM ENGINES
SCALEXTRIC
MOTOR RACING
TRI-ANG RAILWAYS
RADIO CONTROL EQUIPMENT
FLYING MODEL AIRCRAFT
MODEL MAKERS REQUISITES

SOME USEFUL MECHANISMS FOR MECCANO MODELS

AS LONG as a Meccano model-builder occupies himself merely by building the hundreds of models shown in the Instructions Books the work of construction is delightfully simple and easy and no undue brain work is necessary. However, no keen Meccano boy, or girl for that matter, is content to build only the models described and illustrated in the Instruction Books. Sooner or later he desires to branch out into inventing and constructing models based on his own ideas and, with this in mind, we have designed many different kinds of mechanisms especially so that they may be applied to more than one type of model – in many cases without any alteration from our standard pattern – although in some few instances slight modifications may be required. Those boys who like designing and inventing their own models will find these movements very helpful especially as they appear from time to time in Meccano Magazine models.

One of the most popular subjects for Meccano models is the wide range of cranes and the first of the mechanisms we are describing is a useful Automatic Grab device that can be fitted to several different kinds of cranes of the larger type. It is what is known as a single suspension grab and it is shown in Figs. 1 and 2. The grabbing mechanism is very efficient and an important feature is that the trip device that operates the grab is remarkably easy to adjust.

The jaws of the grab are made by bolting $2\frac{1}{2}$ x $1\frac{1}{2}$ in. Triangular Flexible Plates to the flanges of $2\frac{1}{2}$ x $1\frac{1}{2}$ in. Flanged Plates, the Triangular Flexible Plates being strengthened by $2\frac{1}{2}$ in. Strips and $2\frac{1}{2}$ in. Curved Strips joined at their upper ends by Fishplates. A 1 in. Triangular Plate 1 is lock-nutted to the jaws on each side and a $2\frac{1}{2}$ x $\frac{1}{2}$ in. Double Angle Strip 2 is bolted between the upper ends of the Curved Strips. A $1\frac{11}{16}$ in. radius Curved Plate is clamped between this Double Angle Strip and a $1\frac{1}{2}$ x $\frac{1}{2}$ in. Double Angle Strip 3, the lower corners of the Curved Plate being connected to the Flanged Plate by Angle Brackets.

A Coupling is fixed by a Nut on a $\frac{3}{4}$ in. Bolt passed through each Triangular Plate 1, the two Couplings then being connected by a 2 in. Rod. Each Coupling supports a $4\frac{1}{2}$ in. Rod 4, on which another Coupling 5 is free to slide. Couplings 5 are connected by two $2\frac{1}{2}$ in. Rods, each of which carries a further Coupling 6, placed centrally on the Rod. Four $2\frac{1}{2}$ in. Strips are passed over the ends of the $2\frac{1}{2}$ in. Rods and over 2 in. Rods supported in Double Angle Strips 3, to be held on the Rods by Spring Clips.

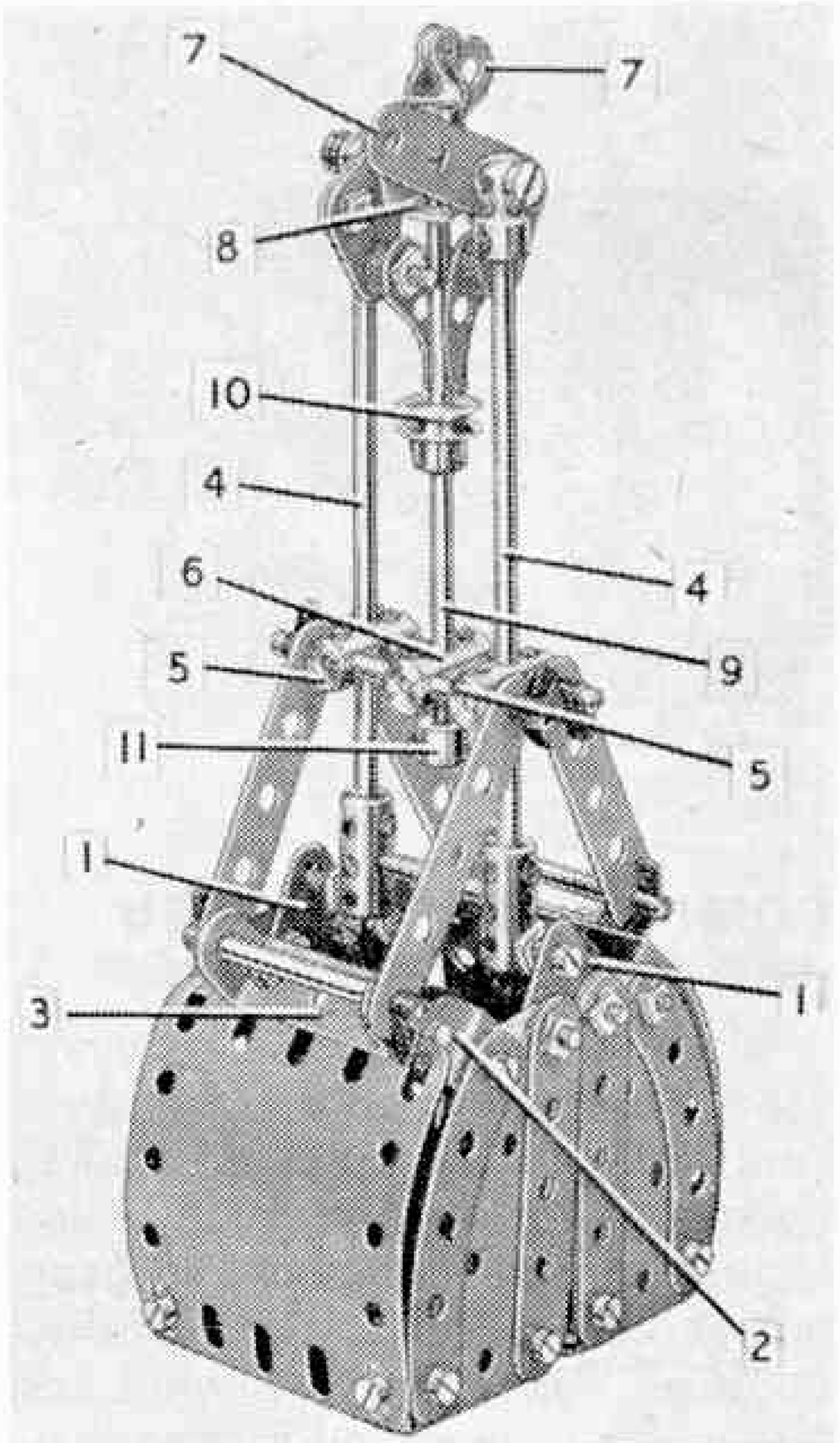
Each Rod 4 carries at its upper end a Handrail Coupling in which a Pivot Bolt is free to turn. A 2 in. Strip 7 is placed on the Pivot Bolt along

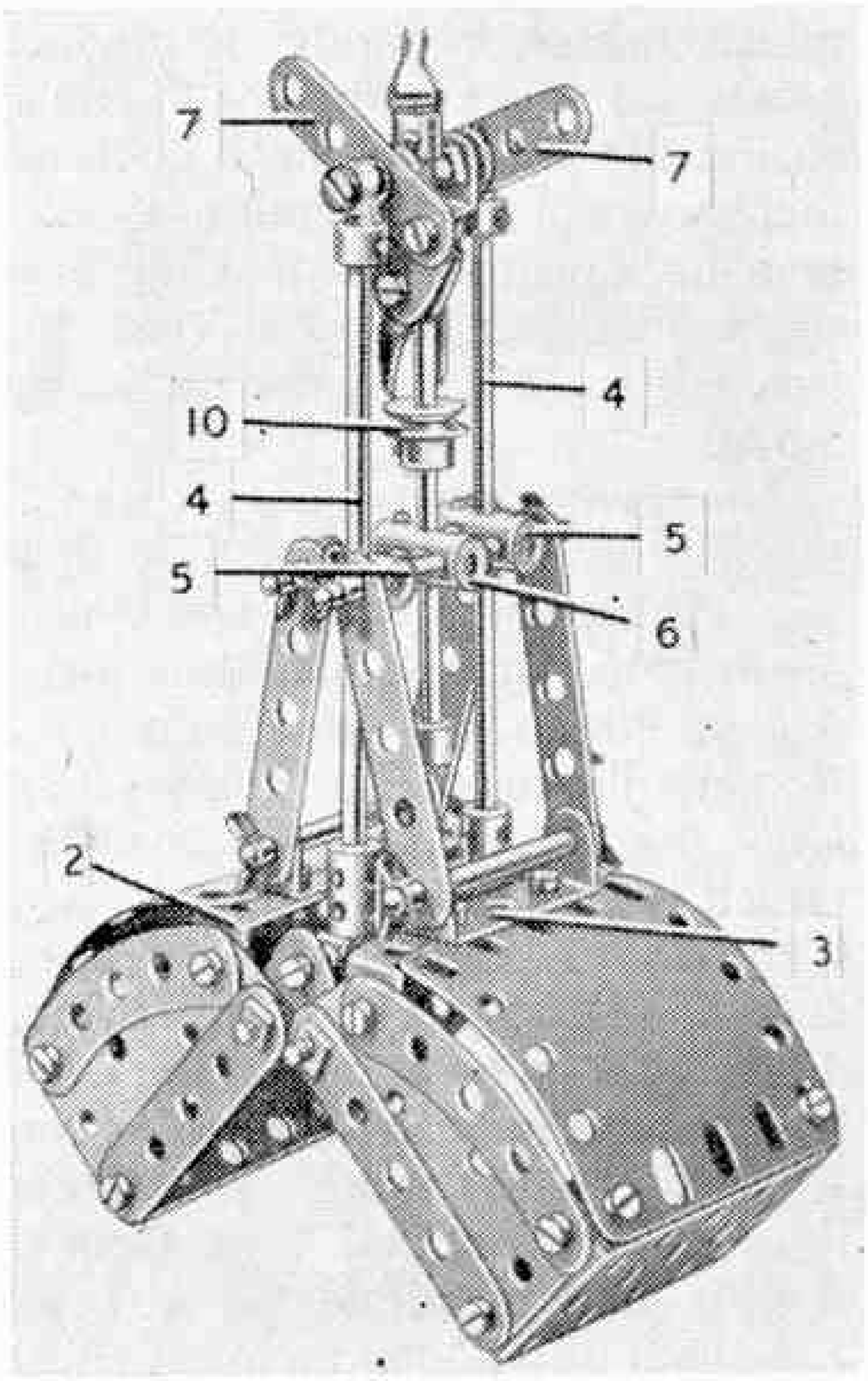
with a 1 in. Corner Bracket that is bolted to one end of the Strip. The Pivot Bolt is then fixed by its Nuts in a Double Bracket 8. A Pawl without boss is attached to each Corner Bracket by a $\frac{1}{2}$ in. Bolt, but is spaced from it by five Washers on the shank of the Bolt.

A $4\frac{1}{2}$ in. Rod 9 is now passed through Double Bracket 8 and a $\frac{1}{2}$ in. Pulley 10 is fixed on the Rod. The Rod is then passed through Coupling 6 and a Collar 11 is fixed on its lower end. An End Bearing placed at the upper end of Rod 9 serves to attach the grab to the crane hook.

In addition to the grab a suspender or trigger ring is required. This can take any convenient form, such as a Cylinder or a ring of Curved Strips, and it should be suspended from the crane jib at the height at which it is required to discharge the grab. The hoisting Cord should pass freely through the centre of the ring, which should be weighted sufficiently to depress the Strips 7 of the grap when these engage the ring as the grab is raised.

The sequence of operations is as follows: assuming the grab to be on the ground with the jaws open (Fig. 2), when the hoisting Cord is raised, Pulley 10 engages the Pawls, which lift Rods 4 and thus close the jaws. The grab can now be lifted, until the Strips 7 engage the suspender ring and, as the Strips are depressed, they move the Pawls clear of Pulley 10. The Rods 4 are then released and the jaws open to discharge the contents of the grab.





Top, fig. 1: a particularly useful mechanism for advanced crane-model builders is this Single Suspension Grab fitted with an automatic discharge unit. Right, fig. 2: another view of the grab in the open position. Note the change in the automatic discharge unit.

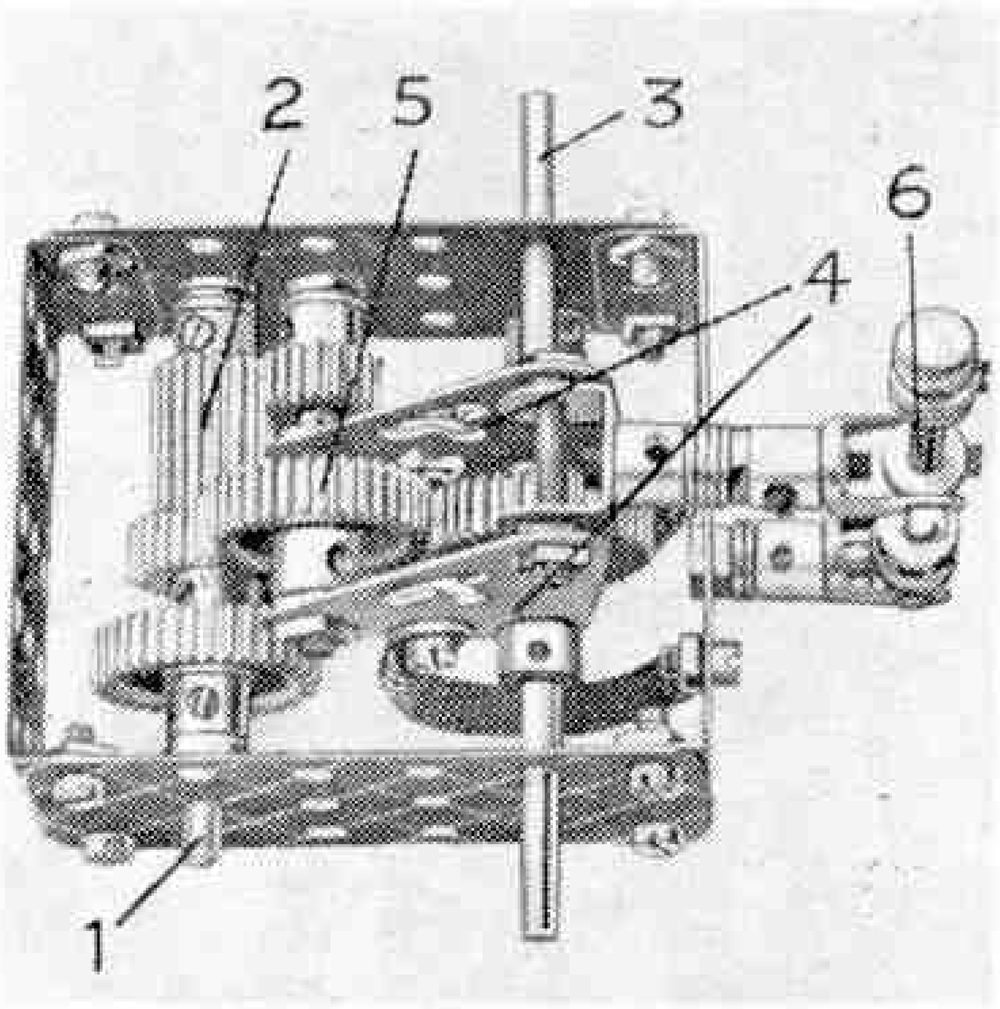


Fig. 3: this compact Three-speed and Reverse Gearbox has the advantages over the more usual types of silent gear-change at any speed and less wear on the teeth of the component gears.

COMPACT THREE-SPEED AND REVERSE GEAR-BOX

Many kinds of models require a variable-speed gearbox of some kind and model-builders finding themselves in need of such a unit should consider whether the gear-box shown in Fig. 3 will meet their purpose. This gives 3-forward and one reverse speed and it is particularly interesting for its compactness which makes it handy in models where space is confined. A suitable casing for the mechanism, such as that shown in the illustration, should first be constructed, making any slight modifications that may be required to fit it into the particular model.

The driving shaft is a 3 in. Rod 1 that carries a $\frac{1}{2}$ x $\frac{3}{4}$ in. Pinion 2, a $\frac{3}{4}$ in. Pinion and a 1 in. Gear, which are fixed to it in the positions shown. A $\frac{1}{2}$ in. Pinion is pivoted on a $\frac{3}{4}$ in. Bolt fixed to the casing, and meshes with the Pinion 2. The layshaft, which is also the driven shaft, is a 4 in. Rod 3, and it carries a 1 in. Gear and two $1\frac{1}{2}$ in. Corner Brackets 4 spaced from each side of the Gear by Washers and held in place on the Rod by two Collars. This Gear meshes with another 1 in. Gear 5 that is free to rotate on a 1 in. Screwed Rod held in Corner Brackets. Two Springs bolted to the Corner Brackets pass around Rod 3 and are then attached to the gear-box casing.

Corner Brackets 4 are also attached to a 1 in. Screwed Rod on which is mounted a Large Fork Piece that is lock-nutted by means of a $1\frac{1}{4}$ in. Bolt and Nuts to the boss of a Swivel Bearing. The Swivel Bearing is attached to the gear selector Rod 6, the lower end of which is inserted in a Universal Coupling fixed to the casing by a Threaded Pin.

To engage a particular gear train the selector Rod 6 is first moved to the right, as seen in the photograph thus releasing gear 5 from engagement. For a lower gear or for reverse ratio the selector is then moved away from the operator, while, for a higher gear ratio, it is pulled towards him.

The drive may be transmitted from the driven shaft 3, to the model in which the mechanism is incorporated by meshing a $\frac{1}{2}$ x $\frac{3}{4}$ in. Pinion, mounted on the Rod with a similar Pinion fixed on a Rod journalled at one of its ends in the gearbox casing.

The advantages of this type of gearbox over the usual kinds are that the gear changing is silent while working at any speed, and there is less wear of the teeth of the gears than in the more conventional types where the gears are slid into mesh while rotating.

DIFFERENTIAL MECHANISM FOR A MODEL CAR

Another useful mechanism – shown in Fig. 4 – is a Differential designed for use in a model car or lorry where the usual shaft drive has

been dispensed with and Sprocket Chain substituted.

To construct it, a 2 in. Sprocket Wheel 1 is secured to a Bush Wheel 2 by means of two $1\frac{1}{2}$ x $\frac{1}{2}$ in. Double Angle Strips, each of the four Bolts fixing these carrying two Washers for spacing purposes. A Rod of sufficient length to reach one of the road wheels is now passed through the boss of the Sprocket Wheel and fitted with a $\frac{3}{4}$ in. Contrate Wheel 3. Sufficient length of the Rod is left projecting in order to allow it to pass into the longitudinal bore of a Coupling 4, then a second Rod, passing through the Bush Wheel, is fitted with a $\frac{3}{4}$ in. Contrate Wheel 5 and inserted in the other end of the Coupling.

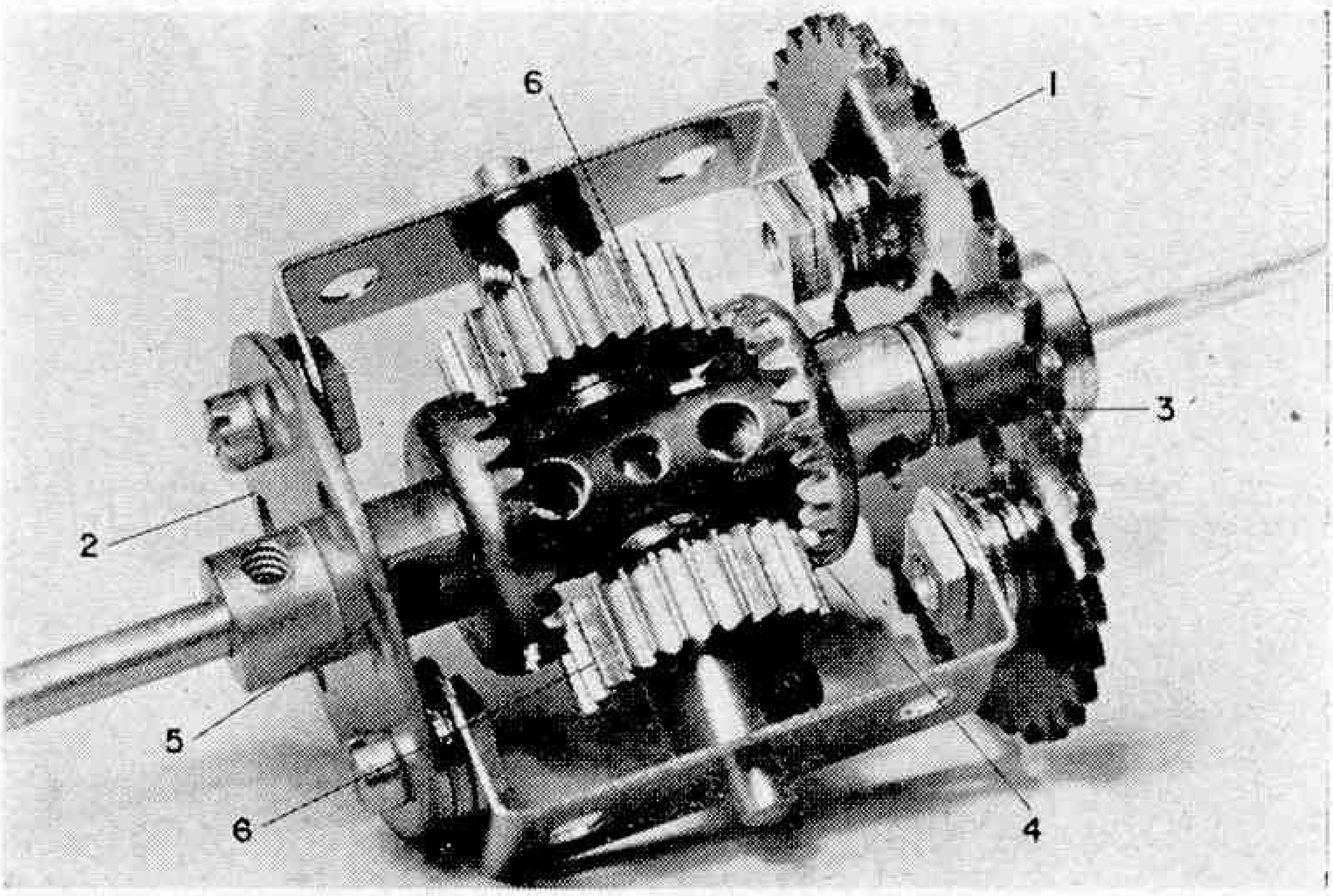
The transverse bore of the Coupling is fitted with a 2 in. Rod that is secured in place by a Grub Screw. This Rod forms a bearing for two $\frac{3}{4}$ in. Pinions 6 that are each spaced away from the Coupling by means of two Washers, so that the Pinions fit snugly against the Double Angle Strips forming the frame of the mechanism. The rear road wheels of the car or lorry are fitted on to the ends of the Rods journalled in Bush Wheel 2 and Sprocket Wheel 1 respectively and, when installed in the model, the drive from the Electric Motor or other power unit is taken by Sprocket Chain to 2 in. Sprocket 1.

The purpose of the differential mechanism is to allow the inner of the two rear wheels of the vehicle when turning a corner, to rotate more slowly than the outer wheel while still allowing the drive to be transmitted to both wheels.

A MECHANISM FOR CRANE BUILDERS

For use in model cranes of the larger and more ambitious types and in certain other kinds of models where a drive of different speeds and capable of being reversed is required, we have designed the comparatively simple but efficient mechanism shown in Fig. 5. This

Fig. 4: a mechanism that can be fitted to many models is this simple but highly effective Differential designed to be driven by Sprocket Chain instead of the usual shaft drive.



does not require many parts and the framework in which it is housed can of course be modified as required to enable it to be fitted into a particular model. The mechanism is designed to give a slow speed in one direction and a rapid speed in reverse, and either Rod 5 or Rod 8 may be used as the driving or input shaft.

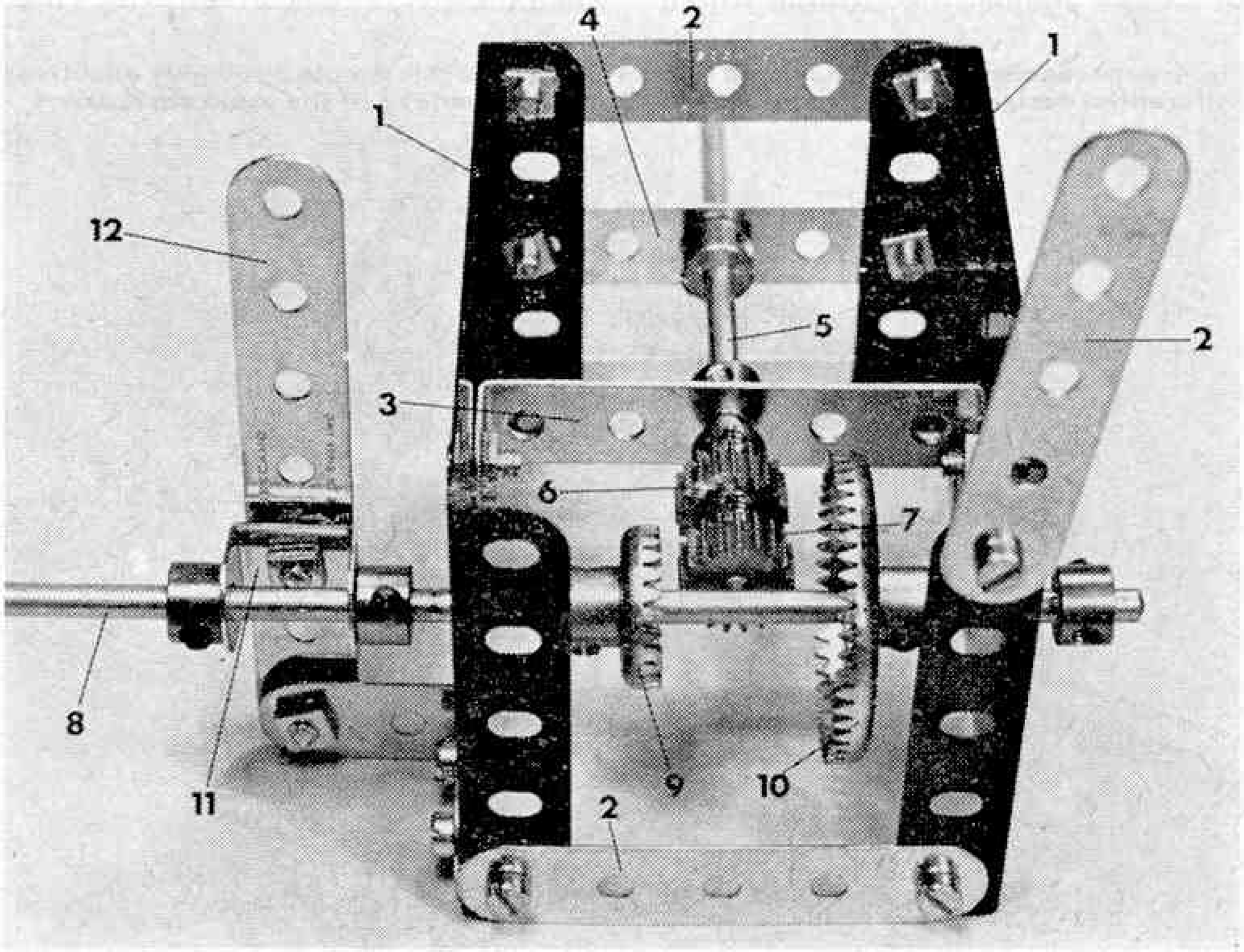
Rod 8 is capable of sliding in its bearings and is controlled by a suitable hand lever 12. This Rod carries two Contrate Wheels 9 and 10, which are $\frac{3}{4}$ in. and $1\frac{1}{2}$ in. in diameter respectively, and on operation of the lever 12 one of them is brought into engagement with one of two $\frac{1}{2}$ in. Pinions secured to the Rod 5. Hence if the Rod 8 is used as the driving shaft and the large Contrate Wheel is thrown into gear with its respective $\frac{1}{2}$ in. Pinion, the Rod 5 is driven nearly 3 times as fast as the Rod 8. This is because the gear ratio between a $\frac{1}{2}$ in. Pinion and a $1\frac{1}{2}$ in. Contrate Wheel is approximately $2\frac{2}{3}$:1.

Alternatively, if the small Contrate Wheel 9 is thrown into engagement, the Rod 5 revolves only a little faster than the driving Rod, the approximate ratio between the two being $1\frac{1}{3}$:1.

If the sliding Rod 8 is required to remain in constant gear with toothed wheels on a further driving Rod, this can be arranged by placing $\frac{1}{2}$ in. Pinions end to end on the Rod 8, making sure that the teeth of the two Pinions line up accurately with each other. These Pinions act as a single toothed unit that may be engaged by a Gear Wheel on the further driving shaft, and the extra width provided by the butted Pinions allows for the longitudinal sliding movement.

Alternatively if a $\frac{1}{2}$ x $\frac{3}{4}$ in. Pinion is available this may be used in place of the two separate $\frac{1}{2}$ in. Pinions.

Fig. 5: a mechanism that is of particular use to crane builders is this Two-speed Reverse Gearbox in which either shaft 5 or shaft 8 will serve as the input or output shaft, as required.



MOTORS AND SPECIAL OUTFITS

A look at the power units designed to drive working Meccano models and at the specialised Outfits not incorporated in the "standard progressive" Meccano system.

REGARDLESS OF the size of the Meccano Outfit which any boy possesses, working models are always favourite. To-day ,the Meccano system offers no less than six different motors to drive the full range of Meccano models: two clockwork and four electric. Of the former category, the No. 1 Clockwork Motor has been well known among Meccano boys for some time as a neat, reliable and compact reversing unit with a powerful spring suitable for driving quite large models. For the smaller Outfits, a simpler non-reversing clockwork unit known as the Magic Motor is available. This is equipped with a permanently-fixed pulley on its output shaft and so is coupled to models by rubber driving bands.

In the electric motor category, Meccano now offer a very versatile range of power units, each one designed to give specific advantages in particular applications, and the four different types available make up a comprehensive 'quartet'. The heaviest motor is the well-known E15R, which, as its code letters indicate, is an electric 15 volt reversing motor that has altered very little in design since its earlier forebears were introduced many years ago. Fitted with drilled side plates and flanges, it may be bolted directly into the machine space of a model where it provides a rigid mounting for supplementary gearing and power take-offs. This motor is an AC/DC unit designed to run from a power source of anywhere between 12 and 15 volts A.C. or D.C. which means that it can be run from the mains via a suitable transformer or transformer/rectifier, or from suitable batteries. It requires a current input of around 1 amp. and, of course, is fitted with radio and T.V. interference suppressors.

At the other end of the scale, the smallest Meccano Electric Motor is the Emebo which is designed to run from dry batteries supplying between $4\frac{1}{2}$ and 12 volts D.C. Although small – it would fit completely into a 2 in. cube – it is an extremely powerful unit for its size. It is fitted with a standard-size Meccano spindle and is supplied complete with a selection of Driving Bands and a $\frac{1}{2}$ in. Pulley, the latter detachable so that belt or gear drive may be taken directly from the

spindle. A single-stage gear train with a reduction ratio of 6.3:1 is built into the unit to increase power and the whole thing is completely enclosed in a polystyrene case. No reversing switch is incorporated, but the Motor can, of course, be easily reversed by changing over the battery leads.

The Emebo Motor has been made for several years now, but a recent introduction to the electric motor range is the Junior Power Drive Unit which consists of a small but powerful electric motor coupled to a reduction gear mechanism, both built into a strong moulded housing designed to look like a piece of full-size electrical plant equipment. The motor will run from a Direct Current Supply of $4\frac{1}{2}$ volts supplied by a battery, such as types Ever Ready 126, Exide H30, or equivalent.

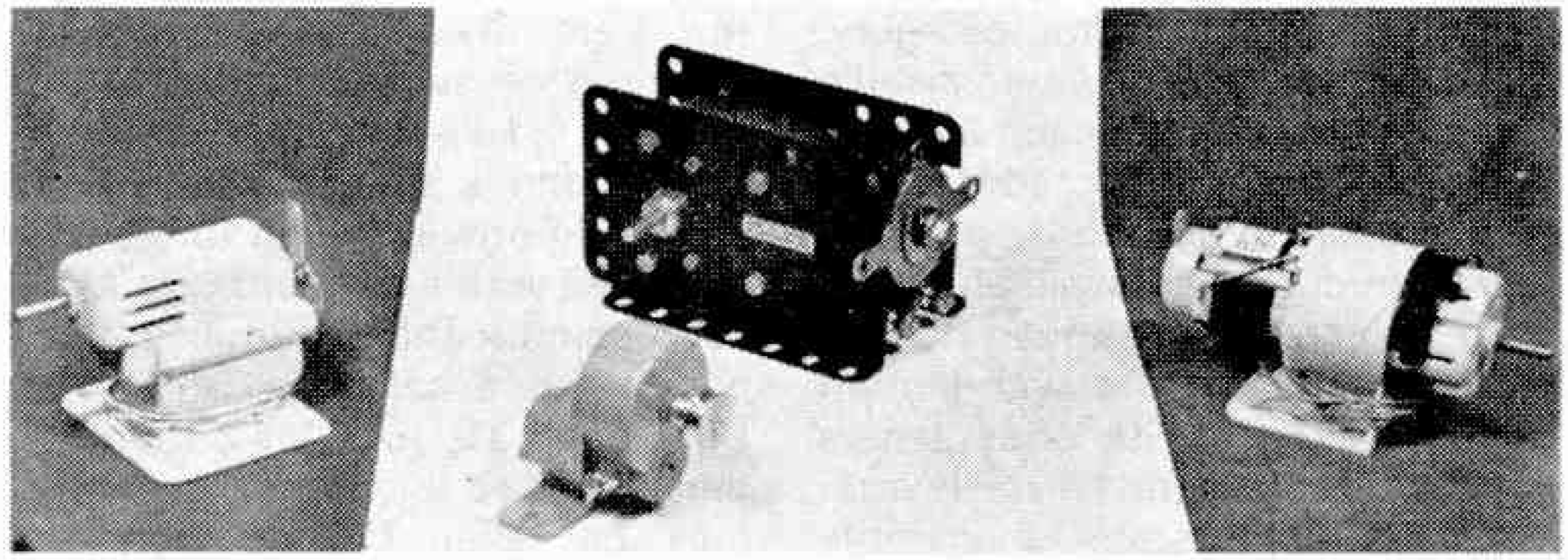
Mounted on the end of the Unit is a stop/forward/reverse lever which incorporates two small holes designed to take lengths of cord or wire so that, if the Unit is built inside a model where it cannot be reached, it can be controlled from elsewhere The speed of the output shaft of the Unit is 1,000 r.p.m. at $4\frac{1}{2}$ volts.

Big brother to the J.P.D.U. is the six-speed, 3-12 volt D.C. Power Drive Unit – a most remarkable piece of equipment. Its unique appeal lies in the fact that this unit has a built-in epicyclic gearbox which gives six ratios varying from 3:1 to 60:1 at the touch of a sliding gear-change selector locked in place by a gear-selector ring running round the outside of the gearbox casing. The modeller may therefore use this power unit for a high-speed, low-torque drive, or a low-speed, high-torque drive without additional gearing. The motor is all enclosed, has a built in reversing switch, six hole mounting and standard drive shaft for pulley or gear take-off.

SPECIAL OUTFITS

Any of the Motors described can be purchased as separate items and no doubt many Meccano boys will be looking forward to acquiring one of these units. The Motors, however, are not the only separate items available, as special outfits outside the 'standard progressive' Sets have also been designed for both the younger enthusiast and for the older boy. Among these are the Junior Power Drive Set and the Power Drive Set respectively, the former containing, in addition to a selection of standard Meccano parts, the Junior Power Drive Unit, while the

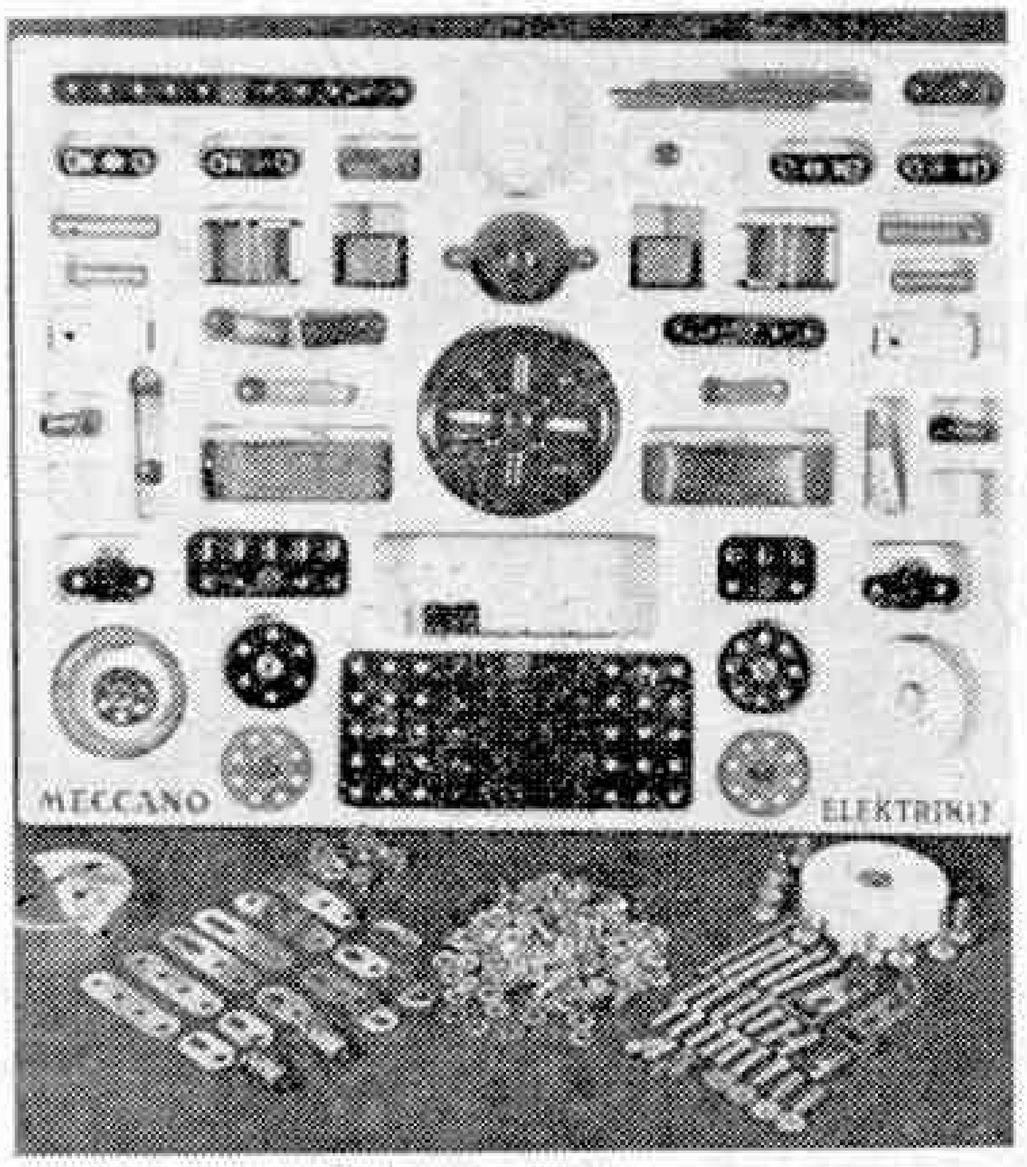
The four Electric Motors marketed by Meccano Limited for use with the Meccano constructional system. Left to right: Junior Power Drive Unit, Emebo Motor, E15R Motor. Power Drive Unit. The last item incorporates a six-speed gearbox.



One of Meccano's special Outfits is the Power Drive Set – a self-contained kit with a Power Drive Unit and sufficient standard Meccano parts to build a great variety of motorised models.

latter contains the larger Power Drive Unit. Each set includes a special Instructions Manual illustrating a range of models all driven by the respective Power Units. In addition, it is possible to build with the Junior Set all the models featured in the manuals up to and including that for standard Outfit No. 3, while No. 4 Outfit models can be produced from the Power Drive Set.

All major components in each Outfit are contained in a well-designed recessed tray made from expanded polystyrene, the recesses being accurately shaped to fit each component exactly so that all pieces may be packed away quickly and neatly into their respective places. This system allows the set owner to tell at a glance if a piece has been left out in the process of putting the set away. In addition to the recessed tray, a new improved packing for Nuts and Bolts and other small pieces has been included in the form of a transparent plastic box with close-fitting lid. Apart from the utility of the packaging generally, the expanded polystyrene is very gentle with the enamelled surface of the Meccano parts so that they retain their new appearance longer. Either of these special outfits makes a very suitable Christmas or birthday present and as both the Power Drive and Junior Power Drive Units



An Outfit which enormously increased the scope of the Meccano system is the Elektrikit, containing a wide range of specially-designed electrical parts.

are battery driven, all working models can be made to work independent of mains electricity supplies.

ELEKTRIKIT

Many model builders are keen to extend the electrical side of their modelling and the ideal way of doing this is by means of the special Meccano Elektrikit Outfit. This contains a large number of specially-made electrical parts which are based on the same standards as Meccano parts so that they may be used in conjunction with them. No special knowledge of Electricity is required as the Elektrikit manual gives all the information required, even for the beginner who is led through simple battery wiring diagrams to the making of switches from Elektrikit Parts and then on to simple electric motors. These and many other facets of electric lighting, electro-magnetic mechanisms etc. are combined at a later stage in the manual for the production of working models in conjunction with standard Meccano parts.

All components are of high quality; coils are pre-wound to accept the correct voltages and contact strips are fitted with silver contacts. A fully-illustrated parts list is shown on the rear cover of the Elektrikit manual and the observant reader will note that there are many parts in the Elektrikit range which lend themselves to practical use in the general model-building category so the acquisition of an Elektrikit Outfit is a double asset to the enthusiast. Pointed Pivot Rods and special recessed bolts open the way to low friction bearings and the black Insulating Strips and Plates can be put to good use in adding realism to built-up contours in certain models. The thin brass Strip, Part No. 530, is an excellent flexible pendulum connector while the Magnet Holder, Part 538 will hold a stack of standard Meccano Strips for rugged stanchions etc. The thin brass Washer is ideal for critical spacing in Meccano Mechanisms and the small 1 in. Bush Wheel gives nice scale to an expanding coupling operating with sliding Threaded Pins running through the holes of a pair of these 1 in. Bush Wheels.

Connecting wire and P.V.C. sleeving may also be used to good effect in decorative work on fairground models, steam engines etc. The keynote, as with all other standardised parts of the Meccano system, is versatility and reliability. The whole system is a wonderful medium in which any Meccano boy, young or old, can exercise his imagination and creative gifts in an infinite number of ways. Equipped with the basic Meccano Outfits and supplemented with the Special Outfits the enthusiast has the mechanical and electrical world at his very fingertips.

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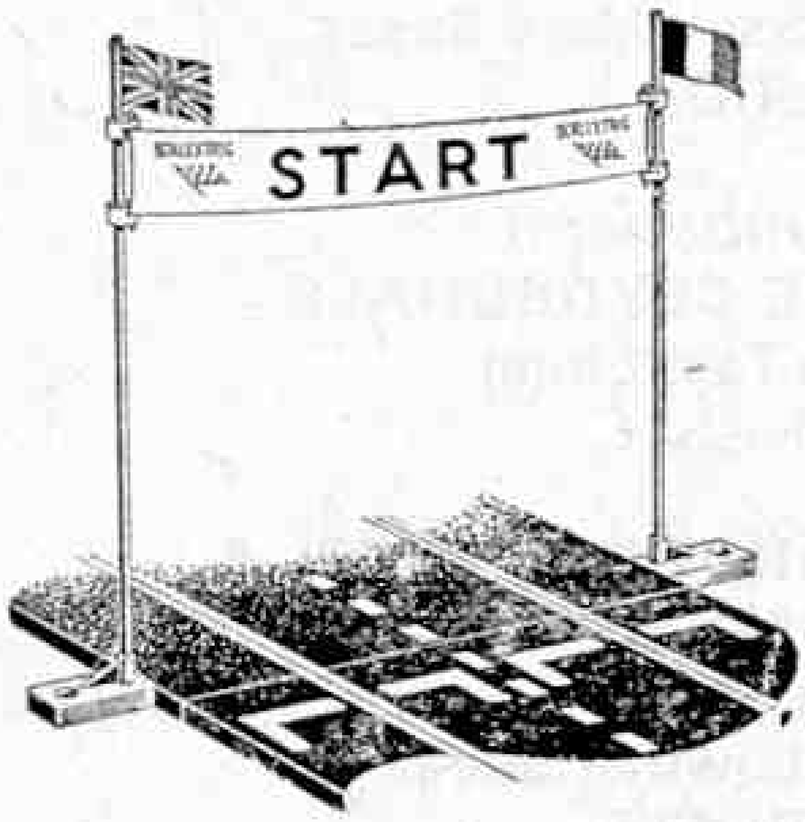

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BRANCHES THROUGHOUT SUSSEX. (SEE INDEX)

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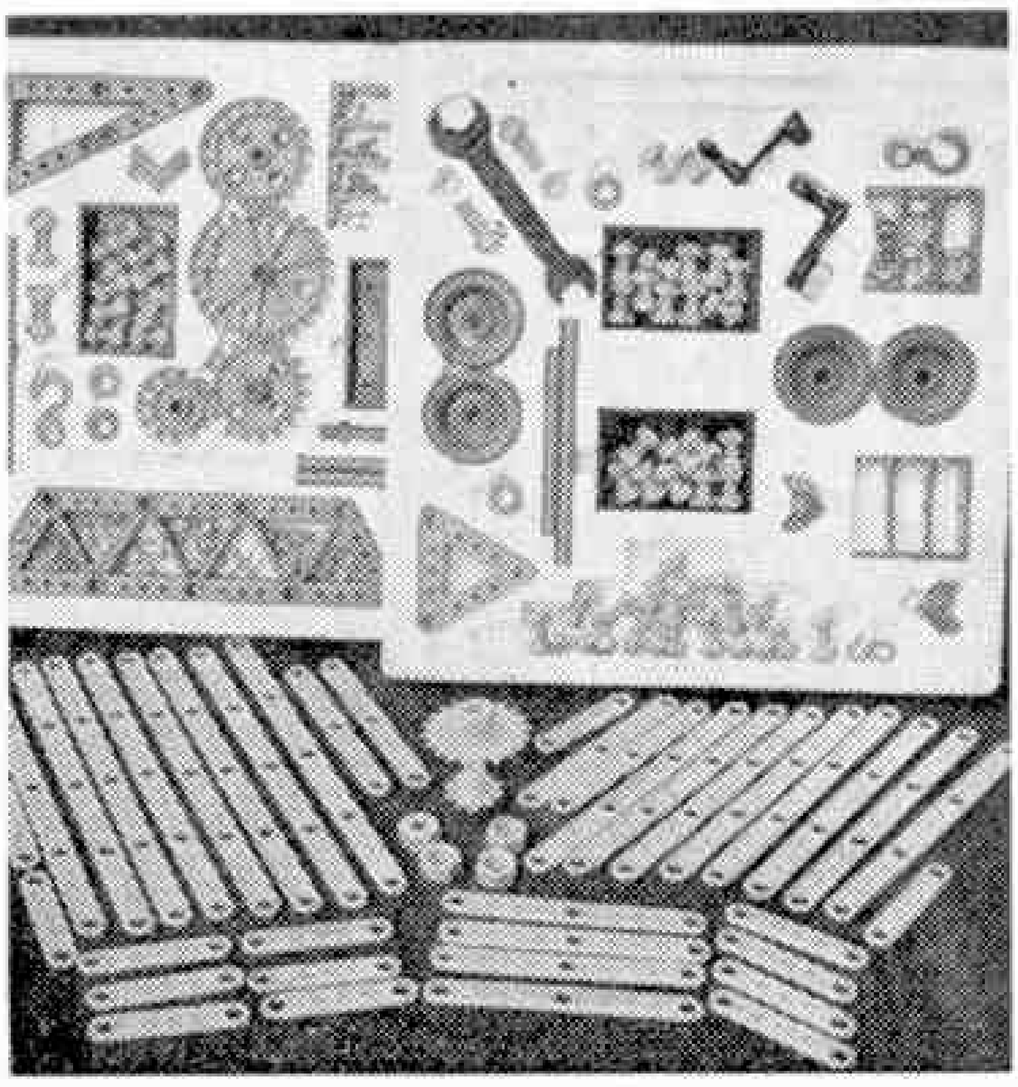
PLASTIC MECCANO

Something for the young and the not-so-young

THERE WAS a time when the younger members of the family could only look upon the construction of Meccano models with envy as their older brothers deftly manipulated such awkward things as Nuts and Bolts, Set Screws, Sprocket Chain and Gear Wheels. Now, thanks to the introduction of Plastic Meccano, youngsters, too, can put pieces together almost as soon as they have learned to make up a uniform pile of wooden blocks or other similar simple exercises in co-ordination of the hand and the eye.

The design of Plastic Meccano is based upon the standard spacing of Meccano Parts and is therefore a useful and remarkable extension of the system as a whole and a wonderful introduction to model-building for the youngest enthusiast. All components are moulded with great accuracy from a very high quality thermo plastic which combines flexibility with rigidity and toughness. It is very durable, wash-

Besides the three main Plastic Meccano Sets, two Accessory Packs are available, one containing a selection of Gear Wheels and the other a selection of Sprockets. This picture shows the Sprocket pack, officially titled Accessory Pack S.



Largest of the three standard Plastic Meccano Outfits is Set C, pictured here neatly laid out!

able and non-toxic so is an ideal material for the very young to handle. A large range of basic parts, modelled on their Meccano counterparts, are included in the Plastic Meccano range. They include Strips in four different lengths, a flanged Base Plate, braced girders and corner brackets as well as Double Angle Strips, Angle Brackets, Axle Clips, a crane Hook, Pulley Wheels, Road Wheels and Spindles. Most remarkable of all the plastic components, however, are the Sprocket Wheels, with highly efficient and most realistic sprocket Chain, and Gear Wheels with beautifully-moulded involute teeth. The Sprocket Wheels and Gear Wheels are keyed to the plastic spindles by a method which is found usually in high precision machinery only, and this is known as the collet construction. Crank handles and Road Wheels are also fixed in the same fashion, i.e. by a large plastic lock-nut which passes over the spindle and engages a thread which is moulded on to one side of the bosses of each of the wheels mentioned. In each case the threaded portion of the boss is split lengthways for a distance of $\frac{1}{2}$ in. to allow the lock-nut to pinch the thread and make a tight fit of the boss on to the shaft.

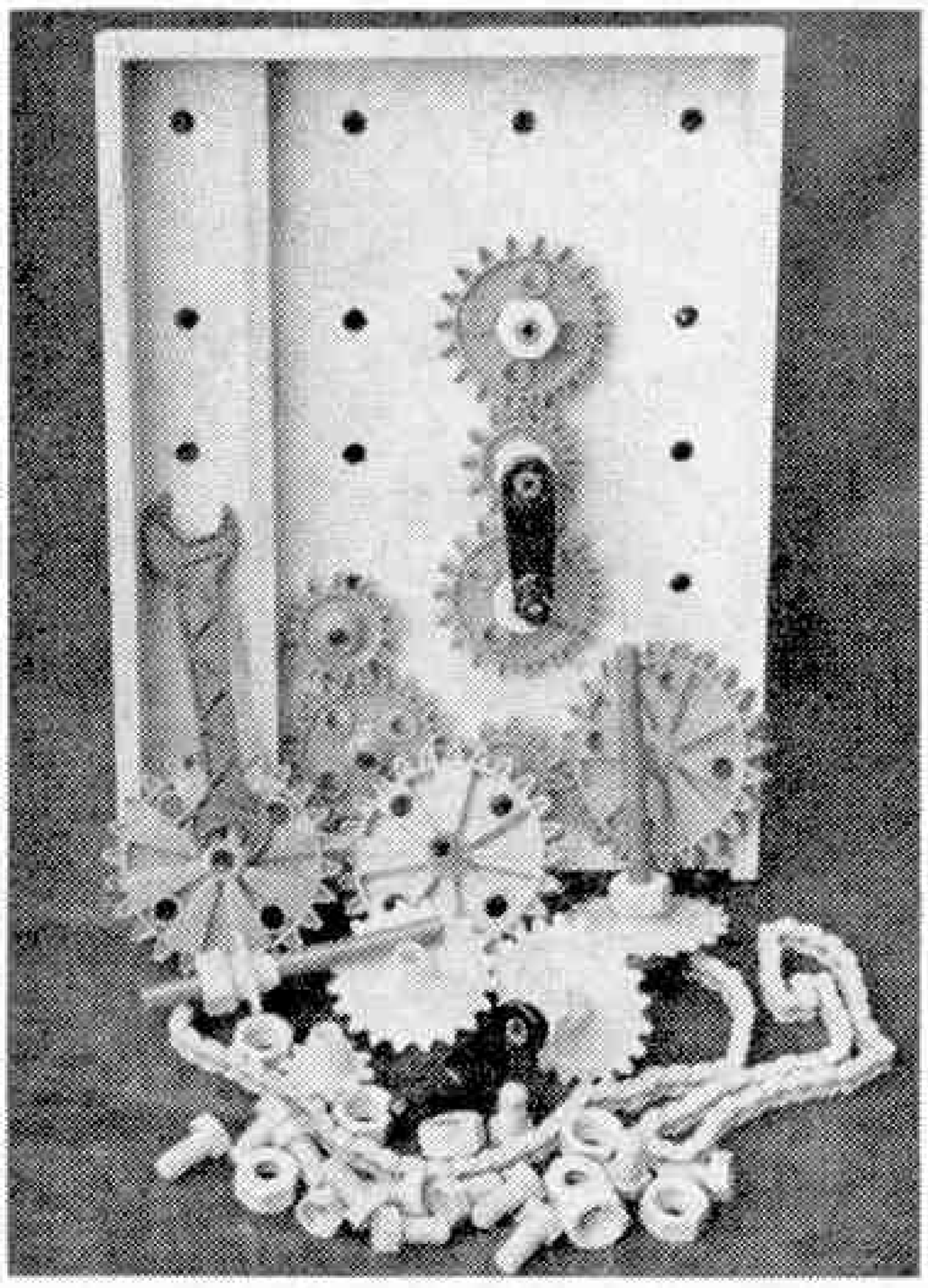
Two sizes of holes are punched in the Plastic Meccano parts: one for standard-size Meccano Rods, Bolts and Screwed Rods, and the other – $\frac{3}{8}$ in. diameter – to accommodate the special, large-size plastic Nuts and Bolts which are formed with hexagon shapes just like standard Whitworth bolts. Also supplied with each Outfit is a plastic Spanner designed to be a neat fit on the Nuts and Bolts and capable of making a tight joint without causing damage to the Parts. It is double ended to accommodate the larger lock-nuts used on the Gear Wheels etc. Two lengths of spindles 4 in. and 6 in. are available ,both designed to fit exactly the large holes in the various Parts. In place, they run very smoothly because the quality of plastic used has an almost slippery surface so that all movements are silent and require no lubrication. The large Bolts are very easy for little hands to manage and, as they are brightly coloured, they are easy to find when it comes to clearing-up time. They, too, come in two sizes, 1 in. and $\frac{3}{4}$ in.

Every Plastic Meccano Outfit has a brightly-coloured model-building sheet on which working models are illustrated in attractive colours matching those of the individual parts. No written instructions are included, but the illustrations show the full details of the model at a glance and provide educational opportunities for the younger children to exercice skill in observation and assembly.

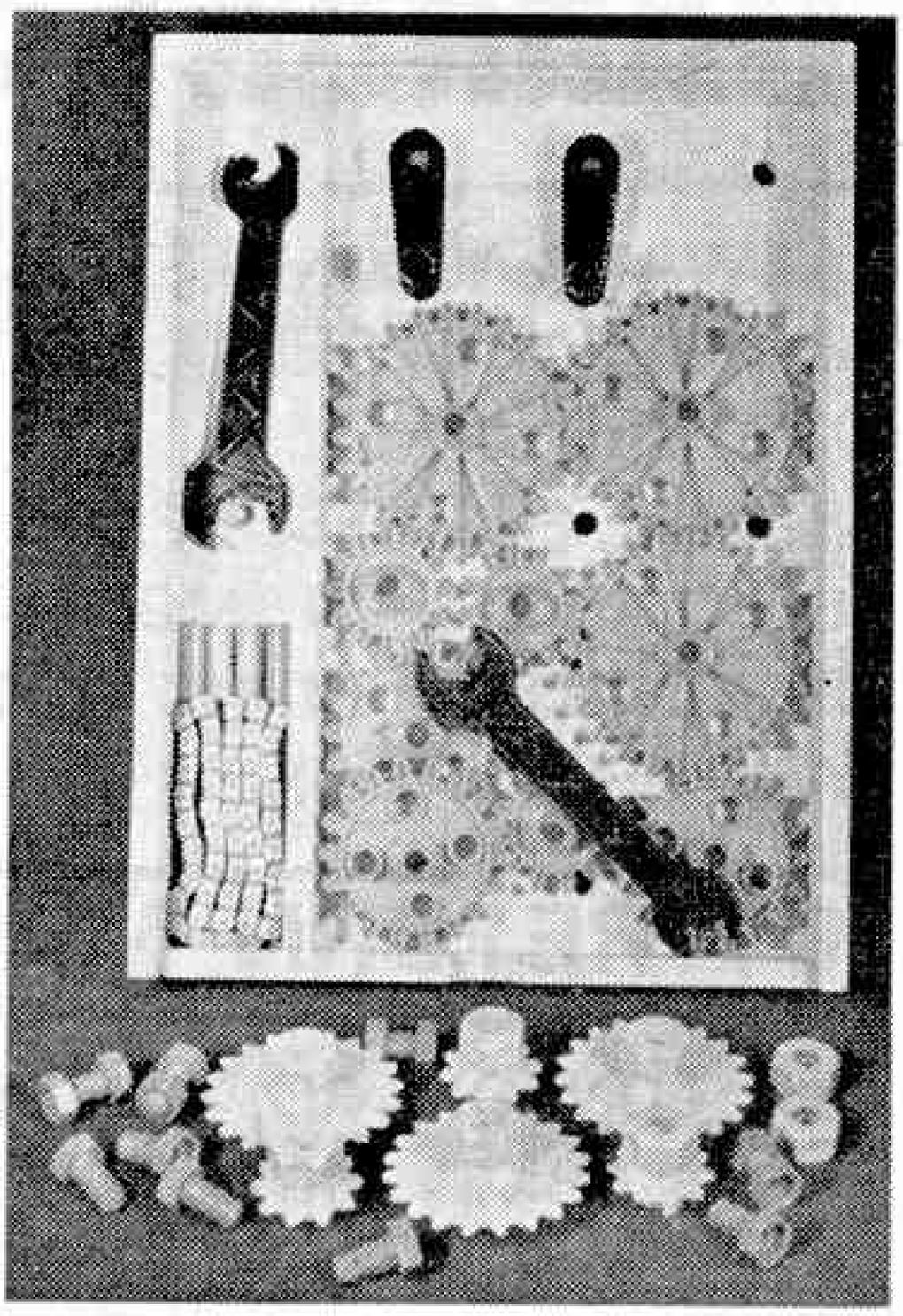
Plastic Meccano need not be limited to the youngster, however. Certain Parts offer plenty of scope for more advanced modellers thanks

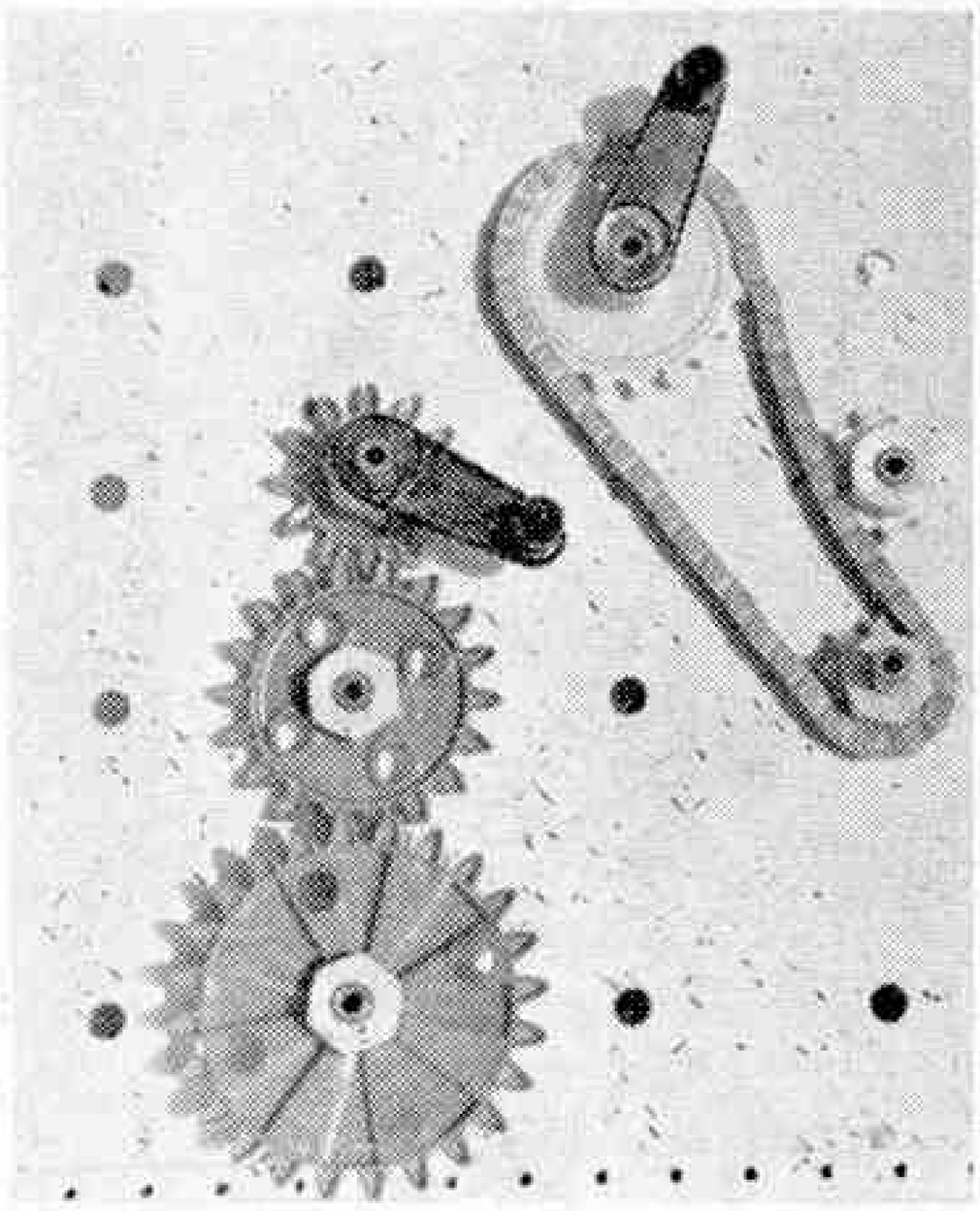
to the foresight of the designers in keeping to standard spacing, thus allowing many plastic parts to be used successfully with Standard Meccano parts. In addition, the plastic Gears and Sprocket Wheels can be keyed to Meccano Rods using a Meccano Coupling, Part No. 63, as an internal boss. The Coupling is simply locked to the Meccano Rod with a short Grub-Screw, Part No. 69c, and the plastic Gear or Sprocket is secured over the Coupling by a plastic Collet-Nut.

On one side of the boss on the plastic Gears and Sprockets, a dog-clutch is moulded to engage with an adjacent Gear etc. if required. The slots in these dog-clutches may also be engaged by a pair of Set Screws in the opposite holes of a Meccano boss on a standard Pulley, Bush Wheel, etc., so that a plastic Gear or Sprocket can be carried between a pair of Meccano wheels or even Collars. The Gears have 12, 18 and 24 teeth respectively so that a number of ratios can be obtained with a powerful and silent drive. The Sprockets, with 10 and 20 teeth, give a 2:1 ratio and, as they can also be keyed to standard Meccano Rods, they can be employed to provide a rugged and realistic chain drive to the tracks of crawler tractors and other heavy mechanisms. The Plastic Meccano Axles are also a neat fit into the wide bores of the Meccano Socket Coupling, Part No. 171, so that large-diameter axles may be used for extra torque. Modellers using large-diameter wheels on Traction Engines or Heavy Tractors can make use of the Plastic Axles which not only pass through the large holes of the plastic Strips but also through the centre of the Meccano Circular Plates, Part Nos. 146 and 146a, as well as through the Hub Disc, Part No. 118 and the Wheel Flange, Part No. 137.



Above and below, these illustrations show just how much the scope of a standard Plastic Meccano Set would be increased by a mixture of both the Gear and Sprocket Accessory Packs.





Plastic Meccano enables even the youngest of us to understand the principles involved in simple gear and sprocket drives.

By arranging suitable spokes or a 'spider' the Meccano Gear Ring, Circular Girder and Circular Strip may also be employed with the Plastic Meccano Axles. A further important asset of the plastic Axles is that they are hollow and will accommodate a Meccano Rod, thus opening up the way to concentric drives and rear axle tubes.

A third plastic Axle is known officially as a Shouldered Spindle, having a shoulder and thread at one end and a thread at the other. Axles of this type can be used as half-shafts where powerful differential drives are required in heavy Meccano models.

To sum up, Plastic Meccano, together with the special Outfits described in a previous chapter, widens the field of experiment and model building even further and is an excellent complementary addition to the Meccano System.

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MECCANO IN INDUSTRY AND RESEARCH

by B. N. Love

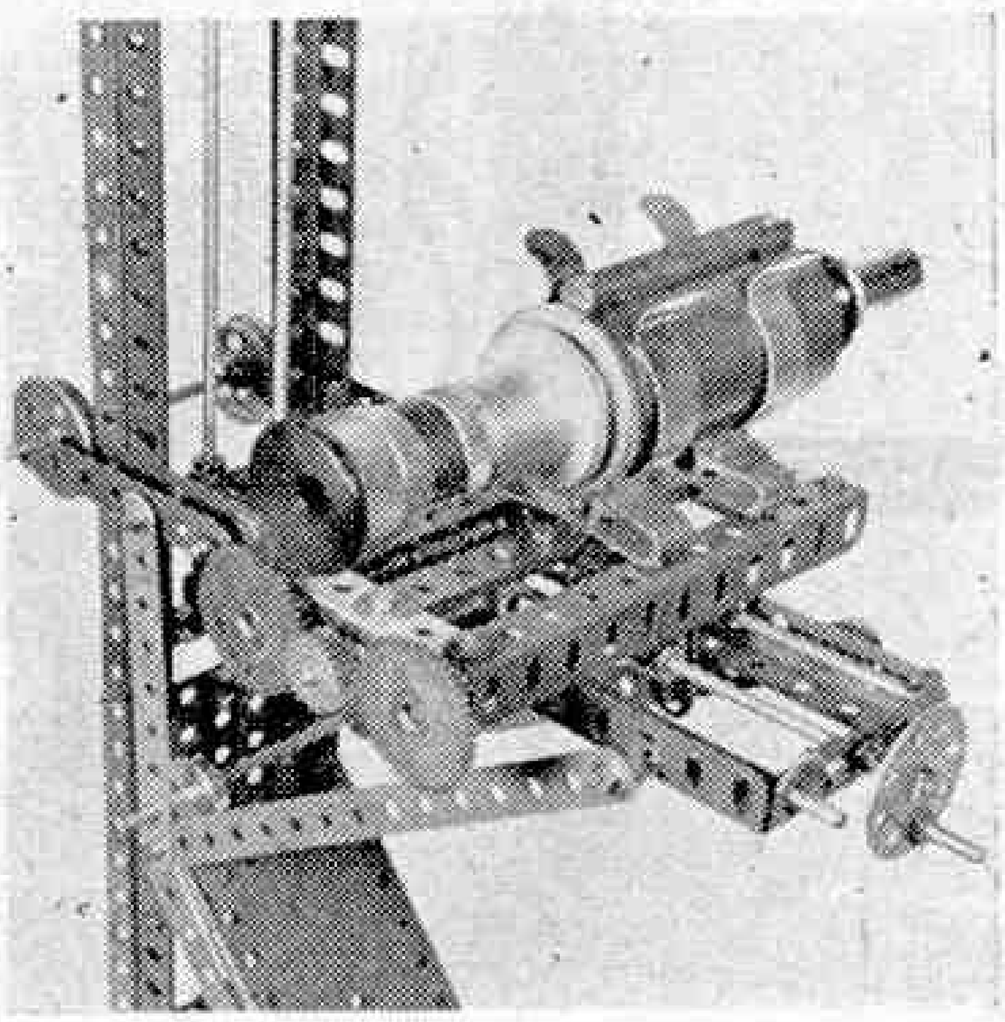
THE UNIQUE appeal of the Meccano system lies in its amazing versatility, It has all too often been looked upon as nothing more than a toy, and it may come as a surprise to many younger readers to realize that Meccano is employed in many branches of Industry and Science as a means of demonstrating scientific principles, building prototypes of engineering models and for investigating a wide field of industrial applications in which custom-built apparatus would (a) be very costly and (b) would lack the adaptability of the simple construction principles employed in the Meccano system.

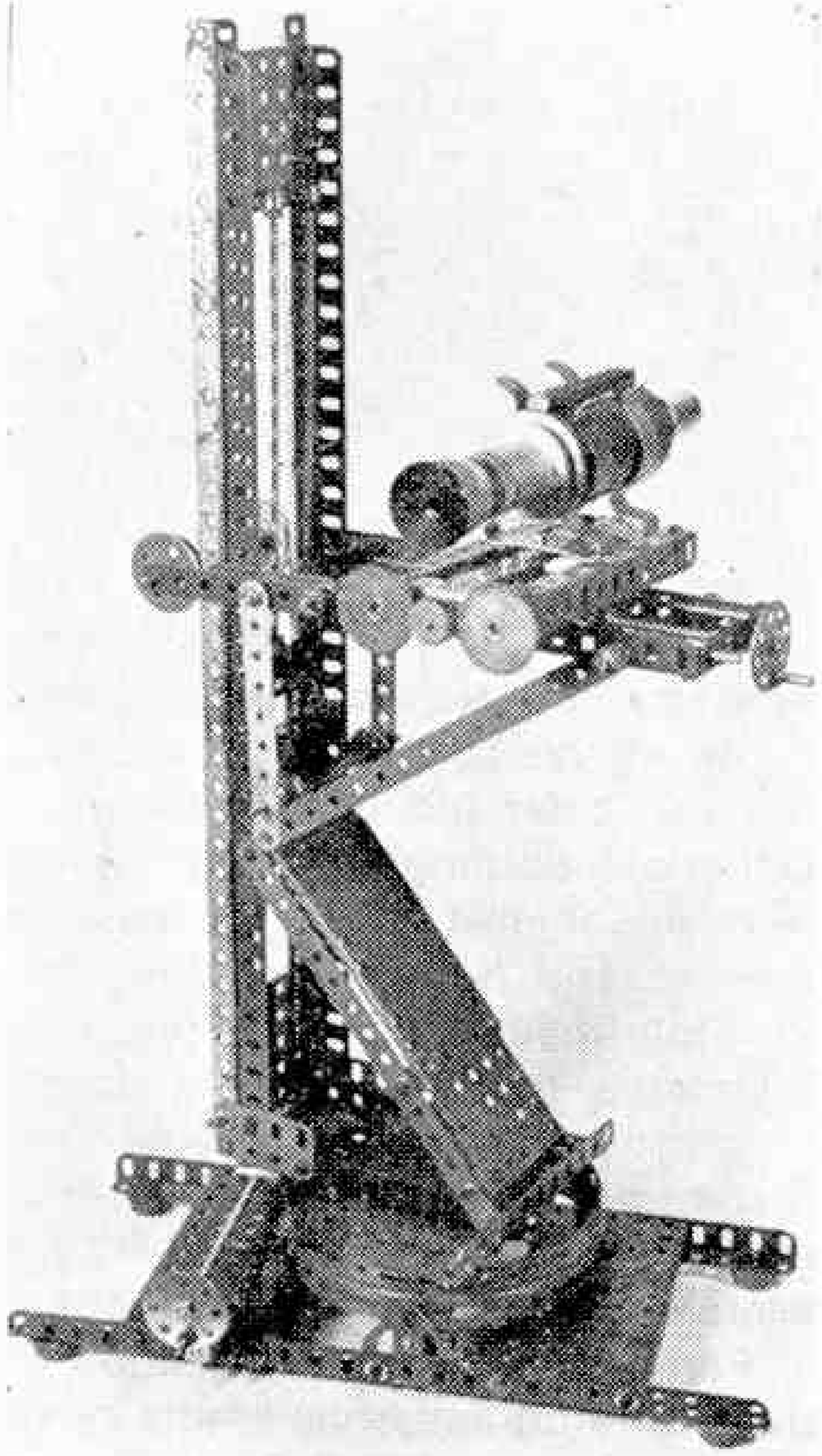
Three examples of the use of Meccano in research are illustrated here, the equipment being designed and built by David Goodman, a research worker at the National Vegetables Research Station, Wellesbourne, Warwickshire. The first of these instruments is a universal mounting for a microscope barrel which may be rapidly and accurately brought into the correct position and focus for studying minute growth measurements in the roots of seedlings. Despite the simplicity of construction the rotating and cross slide motions are quite firm and positive, allowing the operator to take readings in the microscope graticule with complete accuracy.

Although very simple in construction, the second piece of apparatus – a rocking platform actuated by an electric motor-driven crank – gives all that is required for the particular job involved, which is that of recording the oxygenlevels in soil samples when bacteria is present and liquids are circulated through them. The third piece of apparatus, though also very simple in construction and employing very few components, allows an electric needle probe to be lowered into a sample with micrometer accuracy.

Permission for the publication of these photographs has kindly been granted by the N.V.R.S., a Centre which is world famous in agriculture and to whom problems in plant growth are sent from all over the world. The Meccano apparatus illustrated has served its purpose

A close-up view of the cross-slide that holds the microscope barrel showing arrangements for critical adjustment of the microscope in respect of the specimen underneath.



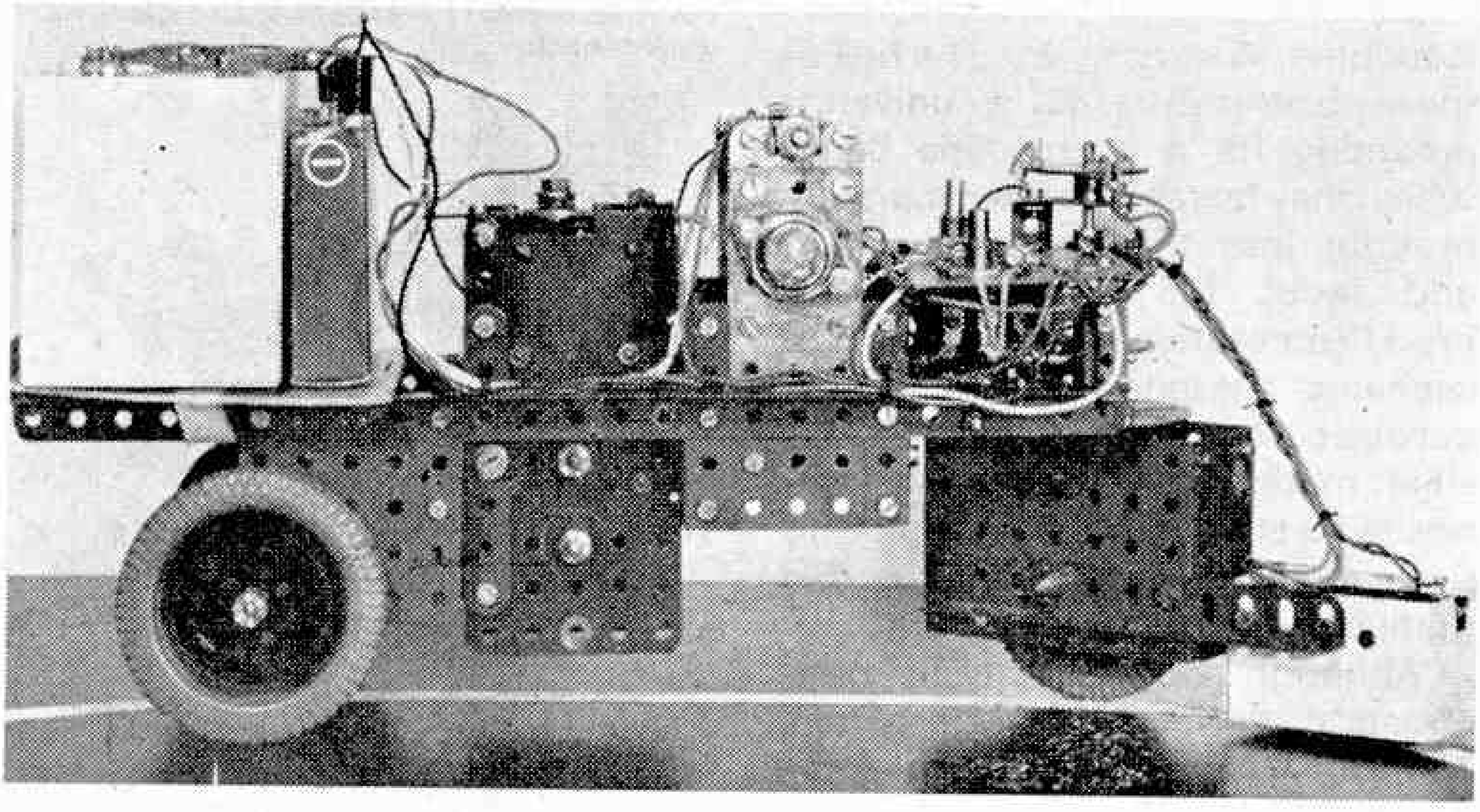


well and, in the case of the micrometer apparatus, has enabled the research station to be the first organization in the world to be able to give an accurate oxygen analysis of a given soil sample.

The developing field of electronics which one normally associates with valves and transistors also calls upon the use of Meccano parts, especially where electro/mechanical applications are involved. A practical example of these was a development by the Mullard Laboratories of a self-steering trolley which would follow a white line painted on a dark surface no matter how the line twisted or turned. The principle upon which the trolley operated relies upon the reflection of light from the white line which is picked up by a pair of photo electric cells incorporated in the steering mechanism. The original trolley was very well illustrated in the January 1962 issue of Meccano Magazine from which it could be seen that its entire mechanical section was built from Meccano parts.

Power for moving the trolley and for operating the steering mechanism was provided by an E.15 R. Electric Motor, the steering column itself being turned left and right by a

Above, this universal mounting rig for a microscope, used by the National Vegetable Research Station at Wellesbourne, Warwickshire, is just one practical example of Meccano in Industry and Research. Below, an improved version of the original self-steering trolley designed by the Mullard Research Laboratories to automatically follow a white line painted on a dark surface.

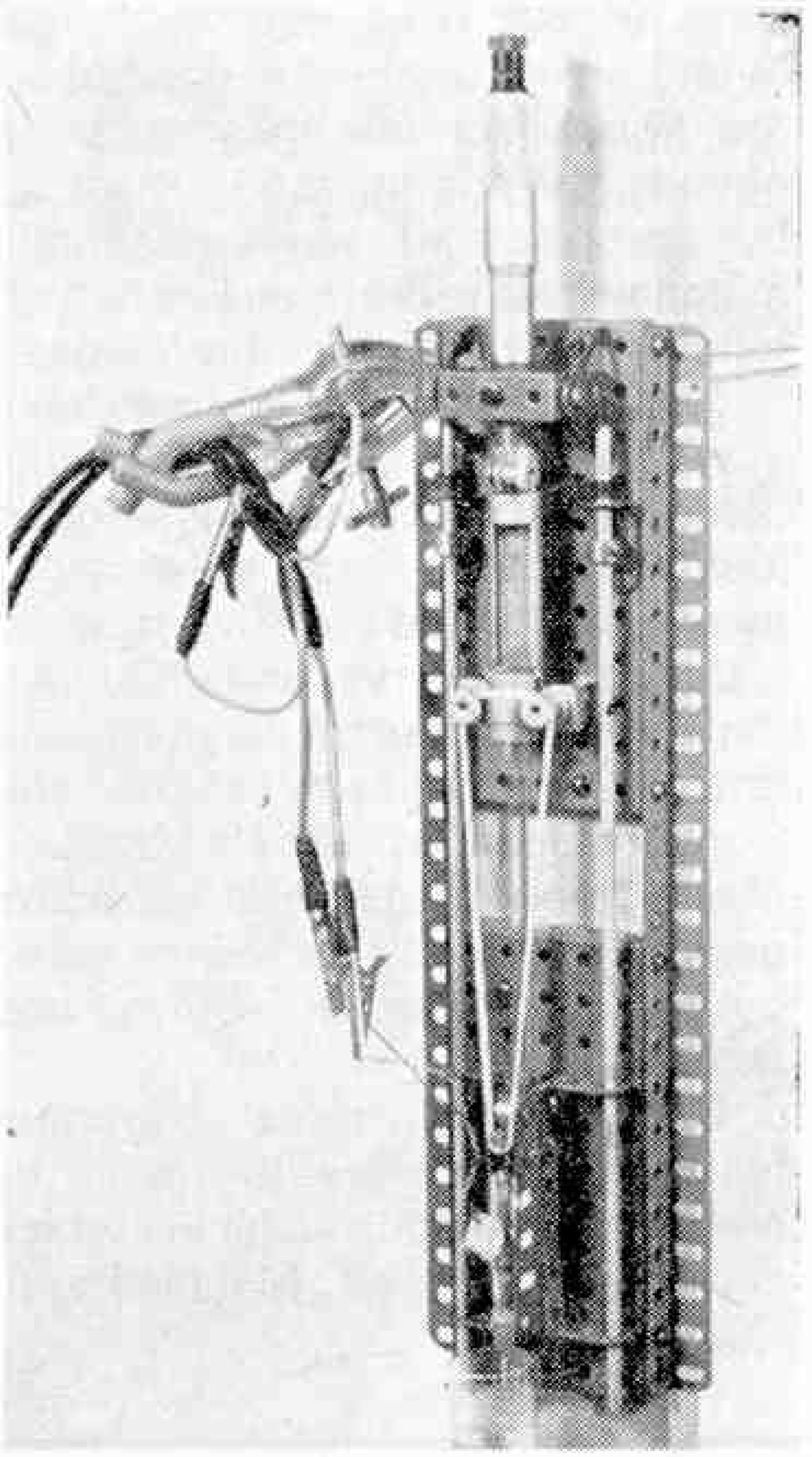


sliding gear change actuated by electro magnets. Originally, the solenoids for these electro magnets were made from Meccano strips, although a later development of the trolley substituted an Emebo Electric Motor for the shift gears in the steering mechanism. Being a D.C. motor, the Emebo is easily reversed by a transistor circuit to which the photo-electric cells are connected.

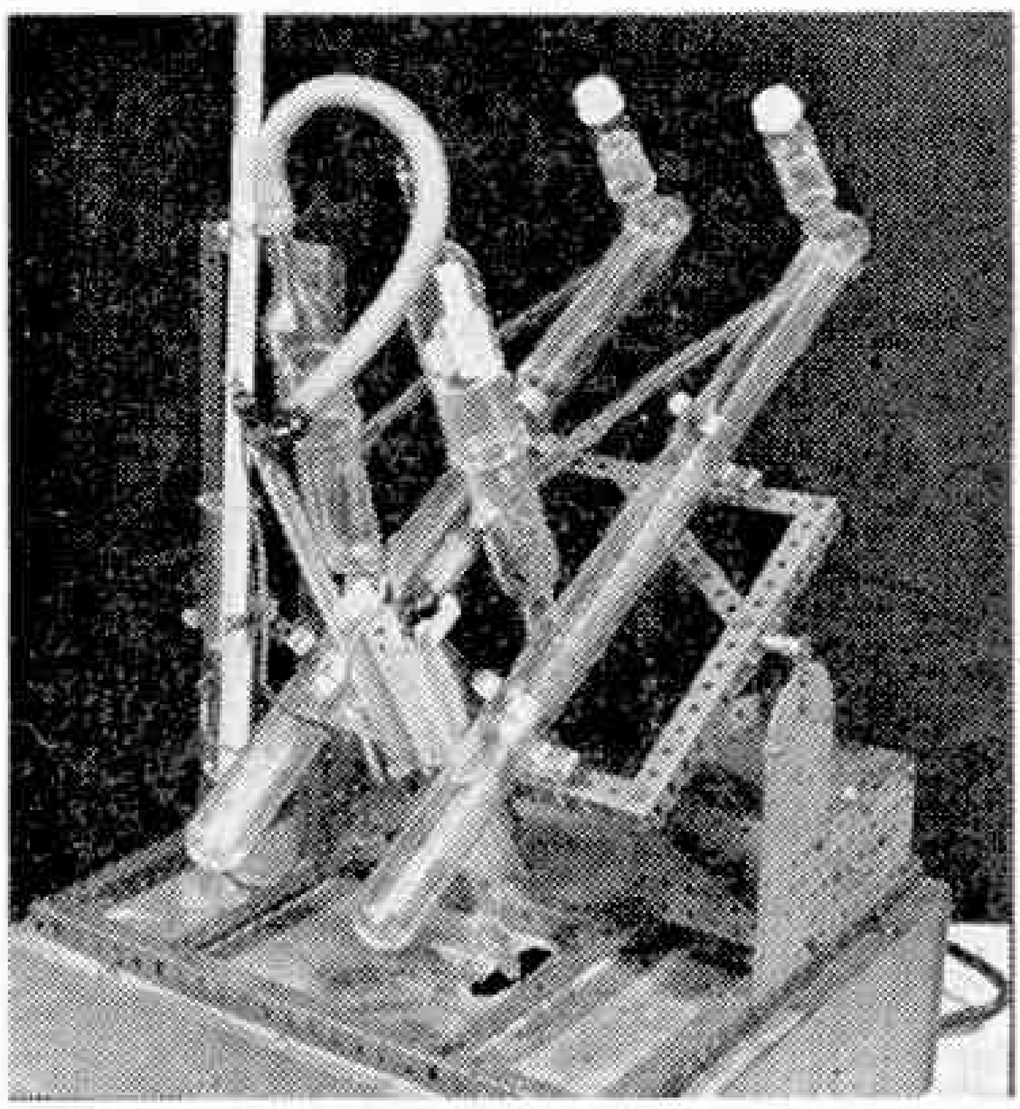
It is now a common sight in factories to have a 'ghost' train consisting of an electric tug which tows several trailers containing factory goods and which weaves itself through a maze of factory corridors completely unattended by a human operator, relying solely on the principle of photo-electric steering as developed in the Meccano self-steering trolley. We are indebted to Dr. H. A. Dell, formerly of the Mullard Research Department for details of the trolley and its development.

The adaptability of the Meccano system is so good that it can be used in cases where absolute sterile conditions are required such as those found in a Pathology Laboratory. It is often necessary to make up solutions which have to be stirred for long periods to ensure absolute uniformity yet which must, at the same time, be protected against contamination and spillage, both of which might result if the stirring 'paddle' were attached to an external mechanism. Such an arrangement would be very difficult to keep sterilised and could permit dust to fall into the solutions.

The answer to the problem is to use a sterile piece of magnetic material inserted into the beaker or vessel containing the sterile solution. The vessel can then be covered with a dust-proof lid and the stirring carried out by simple magnetic induction. A rotating bar of horse-



Above, another piece of Meccano apparatus used by the N.V.R.S. in this rig for the electrical measurement of the oxygen content in a given sample. It gives micrometer control for the insertion of an electrical probe needle into the sample. Below, also used by the N.V.R.S. is this rocking test-rig for circulating fluid nutrients through soil to study oxygen levels in the presence of soil bacteria.



shoe magnet is located very close to and below the beaker containing the liquid. As the magnet spins outside, the stirring action is set up by the piece of sterile magnetic material inside the solution which follows the rotation of the magnet.

Sometimes, it is necessary to have a whole row of sample solutions being stirred at the same time for an identical period. Such an arrangement is easily and quickly set up by standard Meccano and Elektrikit Parts, each permanent magnet being rotated by Meccano shafts and Contrate Gears driven by a Meccano Motor through Meccano reduction gearing, the whole framework being built from Meccano Strips and Girders.

One of the most important features of Industry to-day is its need for automatic machinery which can look after itself. Machinery, in other words, must be developed which has built-in fault-finding and control equipment, capable of 'sens- ng' when the machine has completed a certain task or has reached the required limits of its run, as in the case of a milling machine for example. Controls of this nature are known as 'servo' systems and frequently rely upon a mechanical/ electro 'feed-back' system so that the moment an operation is about to exceed the required limits, the servo system will feed back an instruction to the machine to switch off, change direction, or move to another task. Thanks to the introduction of Elektrikit, designed to standardise with existing Meccano Parts, it is possible to make up prototype servo systems at very little cost and these can be used to form a basis for control design on full scale machines.

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MECCANO SPARE PARTS

5

8

PERFORATED STRIPS

No.		s.	d.	No.		s.	d.
1.	12½"; 32 cm	1/1		3.	3½"; 9 cm	–/6	
1a.	9½"; 24 cm	/10		4.	3"; 7½ cm	–/6	
1b.	7½"; 19 cm	/9		5.	2½"; 6 cm	–/6	
2.	5½"; 14 cm	/8		6.	2"; 5 cm	–/6	
2a.	4½"; 11½cm	/7		6a.	1½"; 38 mm	–/5	

ANGLE GIRDERS

7.	24½"; 62 cm	3/2		9a.	4½"; 11½cm	–/10	
7a.	18½"; 47 cm	2/5		9b.	3½"; 9 cm	–/9	
8.	12½"; 32 cm	1/7		9c.	3"; 7½ cm	–/9	
8a.	9½"; 24 cm	1/4		9d.	2½"; 6 cm	–/9	
8b.	7½"; 19 cm	1/2		9e.	2"; 5 cm	–/8	
9.	5½"; 14 cm	/11		9f.	1½"; 38 mm	–/8	

10

11

11a

12

10.	Fishplate	(6)	–/9
11.	Double Bracket ½"×½"; 12×12 mm		–/3
11a.	Double Bracket 1"×½"; 25×12 mm		–/5

ANGLE BRACKETS

12.	½"×½"; 12×12 mm		–/2
12a.	1"×1"; 25×25 mm		–/5
12b.	1"×½"; 25×12 mm		–/5
12c.	Obtuse. ½"×½"; 12×12 mm	(6)	1/3

AXLE RODS

13.	11½"; 29 cm		/10
13a.	8"; 20 cm		/9
14.	6½"; 16½ cm		/8
14a.	5½"; 14 cm		/7
15.	5"; 13 cm		/7

17

19s

AXLE RODS (continued)

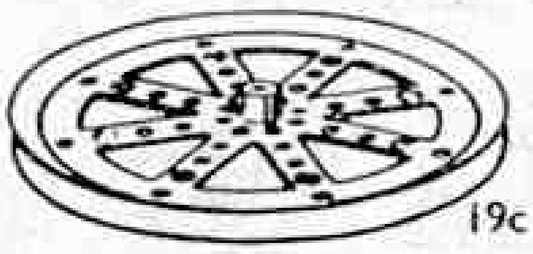
		s.	d.
15a.	4½"; 11½ cm		–/6
15b.	4"; 10 cm		–/6
16.	3½"; 9 cm		–/5
16a.	2½"; 6 cm		–/4
16b.	3"; 7½ cm		–/4
17.	2"; 5 cm		–/3
18a.	1½"; 38 mm		–/3
18b.	1"; 25 mm		–/3
19h.	5"; 13 cm shaft Crank Handle		1/1
19s.	3½"; 9 cm		–/8

19a

20

20b

19a.	Spoked Wheel, 3" diam.; 75 mm		3/–
20.	Flanged Wheel, 1¼" diam.; 28 mm		1/11
20b.	" " ¾" "; 19 mm		1/7



19c

21

22

PULLEYS

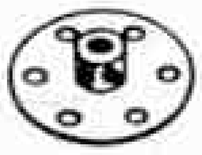
19b.	3" diam. with boss and screw; 7½ cm	1/11	
19c.	6" " " " " " ; 15 cm	7/–	
20a.	2" " " " " " ; 5 cm	1/7	
21.	1½" " " " " " ; 38 mm	1/7	
22.	1" " " " " " ; 25 mm	1/4	

22a

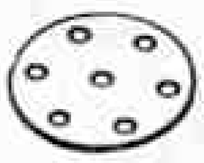
23

PULLEYS (continued)

22a.	1" diam. without boss; 25 mm	–/9	
23.	½" " " " 12 mm	–/6	
23a.	½" " with boss and screw; 12 mm	1/4	



24b



24c

26a

24.	Bush Wheel, 1⅜" diam. 8 holes; 34 mm	1/5	
24a.	Wheel Disc, 1⅜", diam. 8 holes, without boss 34 mm	–/11	
24b.	Bush Wheel, 1⅜" diam. 6 holes; 34 mm	1/5	
24c.	Wheel Disc, 1⅜" diam. 6 holes, without boss 34 mm	–/11	

PINIONS

25.	½" diam.	½" face.	25 teeth;	19×6 mm		2/7	
25a.	½" "	½" "	25 "	19×12 mm		3/2	
25b.	½" "	½" "	25 "	19×19 mm		3/11	
26.	½" "	½" "	19 "	12×6 mm		2/1	
26a.	½" "	½" "	19 "	12×12 mm		2/7	
26b.	½" "	½" "	19 "	12×19 mm		2/11	
26c.	7/16" "	½" "	15 "	11×6 mm		1/9	

27

27d

27b

GEAR WHEELS

27.	1½" diam.	50 teeth;	32 mm			2/2	
27a.	1½" "	57 "	38 mm			2/6	
27b.	3½" "	133 "	9 cm			4/9	
27c.	2½" "	95 "	6 cm			2/10	
27d.	1⅜" "	60 "	41 mm			2/7	

28

29

CONTRATE WHEELS

28.	1½" diam.	50 teeth;	38 mm			2/7	
29.	¾" "	25 "	19 mm			1/10	

30

30a & 30c

31

32

30.	Bevel Gear, ¾" diam., 26 teeth; 22 mm (for use in pairs)	3/9	
30a.	" " ½" " 16 " 12 mm }	1 ea. 11/3	
30c.	" " 1½" " 48 " 38 mm }		
	(Can only be used together)		
31.	Gear Wheel, 1" diam. ½" face, 38 teeth; 25 mm × 6 mm	4/6	
32.	Worm, ½" diam.; 12 mm	1/11	
34.	Spanner	–/8	

34b

35

38d

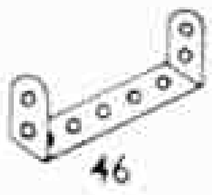
34b	Box Spanner			1/2
35	Spring Clip	Pkt. of 24		1/3
36	Screwdriver			1/3
36a	(longer)			3/11
36c	Drift (for levering bolt holes into line)			/7
37	Nut and Bolt, $\frac{3}{16}$" . 5 mm	Pkt. of 24		2/1
37a	Nut			1/1
37b	Bolt, $\frac{3}{16}$" . 5 mm			1/1
38	Washer $\frac{1}{4}$" . 10 mm		20	/10
38d	$\frac{1}{4}$" . 19 mm		(12)	/10
40	Hank of Cord			/7

41

43

41	Propeller Blade			/11
43	Tension Spring, 2" long, 5 cm			/9

45



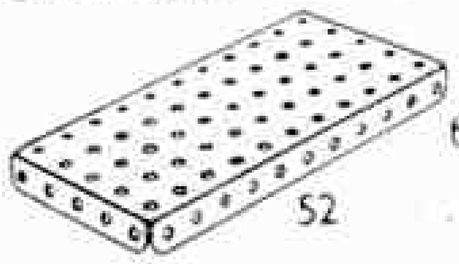
46

44	Bent Strip, Stepped			/7
45	Double Bent Strip			/7

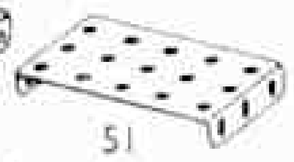
DOUBLE ANGLE STRIPS

			s. d.
46	$2\frac{1}{2}$" × 1" . 60 × 25 mm		/9
47	$2\frac{1}{2}$" × $1\frac{1}{2}$" . 60 × 38 mm		/10
47a	3" × $1\frac{1}{2}$" . 75 × 38 mm		/11
48	$1\frac{1}{2}$" × $\frac{1}{2}$" . 38 × 12 mm		/6
48a	$2\frac{1}{2}$" × $\frac{1}{2}$" . 60 × 12 mm		/7
48b	$3\frac{1}{2}$" × $\frac{1}{2}$" . 90 × 12 mm		/8
48c	$4\frac{1}{2}$" × $\frac{1}{2}$" . 115 × 12 mm		/9
48d	$5\frac{1}{2}$" × $\frac{1}{2}$" . 140 × 12 mm		/10

50

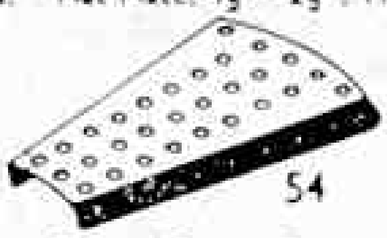


52



51

50	Slide Piece			2/2
51	Flanged Plate, $2\frac{1}{2}$" . $1\frac{1}{2}$" . 60 . 38 mm			/11
52	" " $5\frac{1}{2}$" . $2\frac{1}{2}$" . 14 . 6 cm			2/3
52a	Flat Plate, $5\frac{1}{2}$" . $3\frac{1}{2}$" . 14 . 9 cm			1/5
53	Flanged Plate, $3\frac{1}{2}$" . $2\frac{1}{2}$" . 9 . 6 cm			2/
53a	Flat Plate, $4\frac{1}{2}$" . $2\frac{1}{2}$" . $11\frac{1}{2}$. 6 cm			1/



54

55

54	Flanged Sector Plate, $4\frac{1}{2}$" long; $11\frac{1}{2}$ cm		2
55	Perforated Strip, slotted, $5\frac{1}{2}$" long; 14 cm		8
55a	" " 2" . 5 cm		6

57c

57d

58

58a

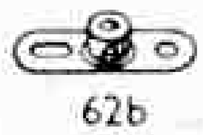
58b

59

57c	Hook, Loaded		/9
57d	Wire Hook		2
58	Spring Cord, 40" length; 1 metre		3/10
58a	Coupling Screw for Spring Cord	(12)	2/6
58b	Hook for Spring Cord	(12)	2/6
59	Collar with screw		/9

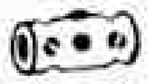
61

62



62b

61	Windmill Sail		1/
62	Crank		1/3
62a	Threaded Crank		1/3
62b	Double Arm Crank		1/3



63

63b

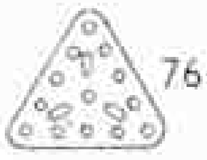
63c

63	Coupling		2/11
63b	Strip Coupling		2/11
63c	Threaded Coupling		2/9
63d	Short Coupling		2/6

64

65

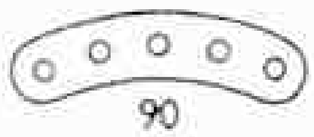
			s. d.
64	Threaded Boss		1/
65	Centre Fork		/8
69	Set Screw, $\frac{3}{16}$" . 4 mm	(12)	1/
69a	Grub Screw, $\frac{3}{16}$" . 4 mm	(12)	1/6
69b	" " $\frac{1}{4}$" . 5 mm	(12)	2/
69c	" " $\frac{1}{8}$" . 3 mm	(12)	2/



76

70	Flat Plate, $5\frac{1}{2}$" . $2\frac{1}{2}$" . 14 . 6 cm	1/3
72	" " $2\frac{1}{2}$" . $2\frac{1}{2}$" . 6 × 6 cm	/11
73	" " 3" . $1\frac{1}{2}$" . 75 . 38 mm	/11
74	" " $1\frac{1}{2}$" . $1\frac{1}{2}$" . 38 × 38 mm	/7
76	Triangular Plate, $2\frac{1}{2}$" . 6 cm	/9
77	" " 1" . 25 mm	/6

80a



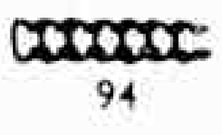
90

SCREWED RODS

		s. d.	No.		s. d.
78	$11\frac{1}{2}$" . 29 cm	3/9	80b	$4\frac{1}{2}$" . $11\frac{1}{2}$ cm	1/10
79	8" . 20 cm	2/9	80c	3" . $7\frac{1}{2}$ cm	/7
79a	6" . 15 cm	2/3	81	2" . 5 cm	/6
80	5" . $12\frac{1}{2}$ cm	2	82	1" . 25 mm	/5
80a	$3\frac{1}{2}$" . 9 cm	1/8			

CURVED STRIPS

		s. d.
89	$5\frac{1}{2}$" (10" radius); 14 cm (25 cm radius)	/9
89a	Stepped, 3" ($1\frac{1}{2}$" radius); $7\frac{1}{2}$ cm ($4\frac{1}{2}$ cm radius)	/8
89b	Stepped, 4" ($4\frac{1}{2}$" radius); 10cm ($11\frac{1}{2}$ cm radius)	/8
90	$2\frac{1}{2}$" ($2\frac{1}{8}$" radius); 6cm (6cm radius)	/6
90a	Stepped, $2\frac{1}{2}$" ($1\frac{1}{8}$" radius); 6cm (35mm radius)	/6



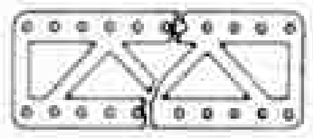
94

95

94	Sprocket Chain, 40" length, 1 metre	3/6

SPROCKET WHEELS

95	2" diam.,	36 teeth;	5 cm	2/8
95a	$1\frac{1}{2}$" "	28 "	38 mm	1/9
95b	3" "	56 "	75 mm	2/11
96	1" "	18 "	25 mm	1/8
96a	$\frac{1}{2}$" "	14 "	19 mm	1/7



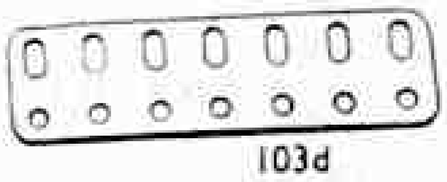
99a

BRACED GIRDERS

97	$3\frac{1}{2}$" long; 9 cm		/11
99	$12\frac{1}{2}$" " 32 cm		2/2
99a	$9\frac{1}{2}$" " 24 cm		1/7
99b	$7\frac{1}{2}$" " 19 cm		1/4
100	$5\frac{1}{2}$" " 14 cm		1/2

101

102

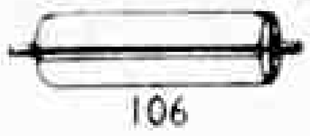


103d

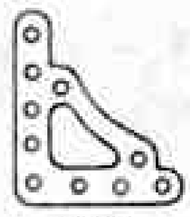
			s. d.
101	Heald for Loom	(24)	1/6
102	Single Bent Strip		/6

FLAT GIRDERS

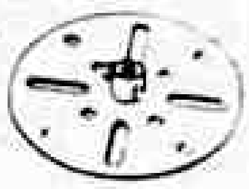
103	$5\frac{1}{2}$" long .	14cm	/11	103e	3" long .	$7\frac{1}{2}$cm	/9
103a	$9\frac{1}{2}$" "	24cm	1/4	103f	$2\frac{1}{2}$" "	6cm	/9
103b	$12\frac{1}{2}$" "	32cm	1/7	103g	2" "	5cm	/8
103c	$4\frac{1}{2}$" "	$11\frac{1}{2}$cm	/10	103h	$1\frac{1}{2}$" "	38mm	/8
103d	$3\frac{1}{2}$" "	9cm	/9	103k	$7\frac{1}{2}$" "	19cm	1/2



106



108



109

106	Wood Roller (complete with Rod and two Collars)	5
108	Corner Gusset	9
109	Face Plate, 2½" diam.; 6 cm	1/7

110a

113

110	Rack Strip, 3½" long; 9 cm	1/2
110a	" " 6½" " 16½ cm	1/5

BOLTS

111	¾"; 19 mm (12)	1/3
111a	½"; 12 mm (12)	9
111c	⅜"; 9½ mm (12)	9
111d	1⅛"; 28½ mm (12)	1/9
113	Girder Frame	1/4

114

115

116a

114	Hinge	1/-
115	Threaded Pin	1/-
115a	Threaded Pin, Long 1⅜"; 34 mm	1/4
116	Fork Piece, large	1/4
116a	Fork Piece, small	1/2

118

120b

122

118	Hub Disc, 5½" diam.; 14 cm	4/6
120b	Compression Spring, ⅝" long; 14 mm	3
122	Loaded Sack	10

123

125

126

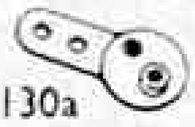
123	Cone Pulley, 1½", 1" and ¾" diam. 32 × 25 × 19 mm	6/-
124	Reversed Angle Bracket, 1"; 25 mm	-/5
125	" " ½"; 12 mm	-/4
126	Trunnion	-/8

126a

128

126a	Flat Trunnion	-/6
128	Bell Crank, with boss	1/5

130


130a

130	Eccentric, Triple Throw, ½", ⅜" and ¼" 6 × 9 × 12 mm	5/6
130a	Eccentric, Single Throw, ¼"; 6 mm	3/10

133

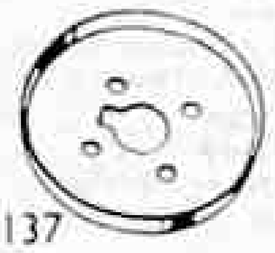
133a

134

133	Corner Bracket, 1½"; 38 mm	-/7
133a	Corner Bracket, 1"; 25 mm	-/5
134	Crank Shaft, 1" stroke; 25 mm	-/9

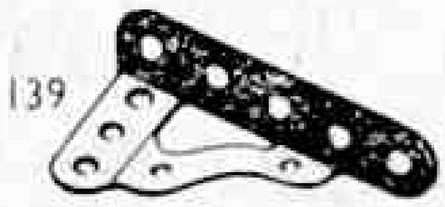
136

136a


137

138

136	Handrail Support	2/2
136a	Handrail Coupling	2/2
137	Wheel Flange	1/1
138	Ship's Funnel, Raked	3/3


139

140

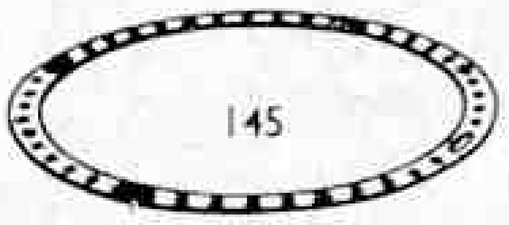
139	Flanged Bracket (right)	/11
139a	" " (left)	/11
140	Universal Coupling	3/9

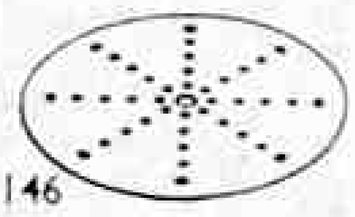
142c

143

144

		s.	d.
142a	Motor Tyre (to fit 2" diam. rim); 5 cm	2	3
142b	" " " 3" " " 7½cm	3	9
142c	" " " 1" " " 25 mm		9
142d	" " " 1½" " " 38 mm	1	6
143	Circular Girder, 5½" diam.; 14 cm	4	3
144	Dog Clutch	2	3

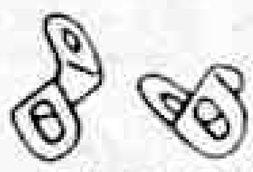

145


146

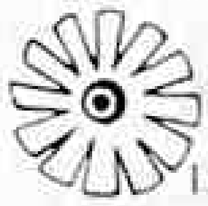
145	Circular Strip, 7½" diam. overall; 19 cm	3 3
146	Circular Plate, 6" diam. overall; 15 cm	3 6
146a	" " 4" diam. overall; 10 cm	2 3

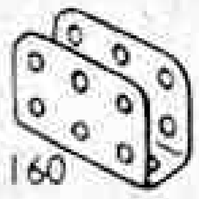
147 & 148

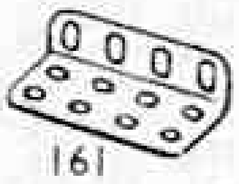
153


154a & 154b

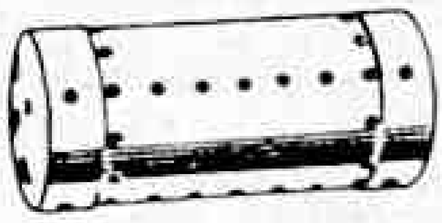
147	Pawl with Pivot Bolt and Nuts	1 7
147a	Pawl	11
147b	Pivot Bolt, with two Nuts	9
147c	Pawl, without boss	4
148	Ratchet Wheel	2 1
151	Single Pulley Block	3 11
153	Triple Pulley Block	4 11
154a	Corner Angle Bracket, ½" (right-hand), 12mm	6
154b	Corner Angle Bracket, ½" (left-hand), 12mm	6
155	Rubber Ring (for 1" Pulley), 25 mm	6


157


160


161

157	Fan, 2" diam.; 5 cm	2 3
160	Channel Bearing, 1½" × 1" × ½"; 38 × 25 × 12 mm	9
161	Girder Bracket, 2" × 1" × ½", 50 × 25 × 12mm	8

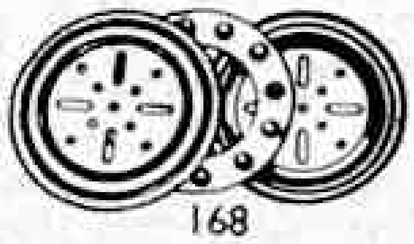

162

164

162	Boiler, complete, 5" long × 2⅛" diam. 12½ × 5 cm	4 3
162a	Boiler, End 2⅛" diam. × ½"; 50 × 19mm	1 3
163	Sleeve Piece, 1½" long × ⅝" diam. 38 × 17 mm	9
164	Chimney Adaptor, ¾" diam. × ½" high 16 × 12 mm	1 2

165

166


168

		s.	d.
165	Swivel Bearing	2	11
166	End Bearing	1	5
167b	Flanged Ring, 9½" diam., 25 cm	7	9

168.	Ball Thrust Bearing, 4" diam.; 10 cm	6/3
168a.	Ball Thrust Race, flanged disc, 3¾" diam.; 9½ cm	2/3
168b.	Ball Thrust Race, toothed disc, 4" diam; 10 cm	2/3
168c.	Ball Cage, 3⅜" diam., complete with balls; 9 cm	3/11
168d.	Ball, ⅜" diam.; 9½ mm	/3

171

173a

176

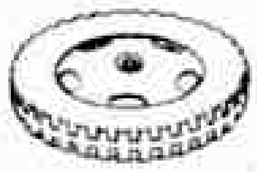
171.	Socket Coupling	3/9
173a.	Adaptor for Screwed Rod	/10
175.	Flexible Coupling Unit	3/-
176.	Anchoring Spring for Cord	/6

179

180

179.	Rod Socket	1/9
180.	Gear Ring, 3½" diam. (133 ext. teeth, 95 int.) 9 cm	3/11

185


187

185.	Steering Wheel, 1¾" diam.; 4½ cm	1/9
185a.	" " 2½" diam.; 6 cm	1/11

DRIVING BANDS

186.	2½" (light): 6 cm	/2
186a.	6" " 15 cm	/4
186b.	10" " 25 cm	/6
186c.	10" (heavy): 25 cm	/8
186d.	15" " 37½ cm	1/-
186e.	20" " 50 cm	1/3
187.	Road Wheel, 2½" diam.; 60 mm	1/9
187b.	Road Wheel, 4¼" diam.; 108 mm	4/-
187a.	Conical Disc, 1⅞" diam.; 47 mm	/10

190a

FLEXIBLE PLATES

188.	2½" × 1½"; 60 × 38 mm.	/7
189.	5½" × 1½"; 140 × 38 mm	/11
190.	2½" × 2½"; 6 × 6 cm	/10
190a.	3½" × 2½"; 9 × 6 cm	/11
191.	4½" × 2½"; 11½ × 6 cm	1/-
192.	5½" × 2½"; 14 × 6 cm	1/1

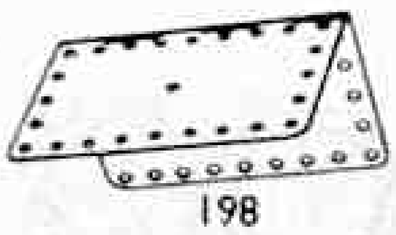
PLASTIC PLATES

				s. d.
193.	2½" × 1½"	(Transparent);	60 × 38 mm	/6
193a.	2½" × 2½"	"	; 60 × 60 mm	/7
193b.	3½" × 2½"	"	; 90 × 60 mm	/9
193c.	4½" × 2½"	"	; 115 × 60 mm	/10
193d.	5½" × 1½"	"	; 140 × 38 mm	/8
193e.	5½" × 2½"	"	; 140 × 60 mm	/11
194.	2½" × 1½"	(Black)	; 60 × 38 mm	/6
194a.	2½" × 2½"	"	; 60 × 60 mm	/7
194b.	3½" × 2½"	"	; 90 × 60 mm	/9
194c.	4½" × 2½"	"	; 115 × 60 mm	/10
194d.	5½" × 1½"	"	; 140 × 38 mm	/8
194e.	5½" × 2½"	"	; 140 × 60 mm	/11

197

STRIP PLATES

195.	7½" × 2½"; 19 × 6 cm	1/8
196.	9½" × 2½"; 24 × 6 cm	2/-
197.	12½" × 2½"; 32 × 6 cm	2/6


198

199

200

201

198.	Hinged Flat Plate, 4½" × 2½"; 11½ × 6 cm	2/11
199.	Curved Plate, U-Section, 2½" × 2½" × 5/16" radius; 60 × 60 × 7 mm	/10
200.	Curved Plate, 2½" × 2½" × 1 11/16" radius; 60 × 60 × 43 mm	/10
201.	Flexible Gusset Plate, 2½" × 2½"; 60 × 60 mm	/9

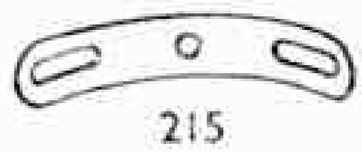
211a & 211b

212a

213

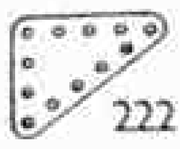
211a.	Helical Gear, ½": 12 mm { Can only be used together }	1 ea. 11/3
211b.	" " 1½": 38 mm	
212.	Rod and Strip Connector	/7
212a.	Rod and Strip Connector, Right Angle	/7
213.	Rod Connector	/6
213a.	Three-way Rod Connector	/10
213b.	Three-way Rod Connector with boss	1/8

214


215

216

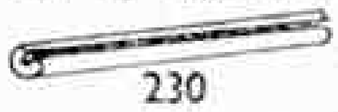
214.	Semi-Circular Plate, 2½"; 6 cm	/11
215.	Formed Slotted Strip, 3"; 7½ cm	/8
216.	Cylinder, 2½" long, 1¼" diam.; 60 × 30 mm	1/7


222

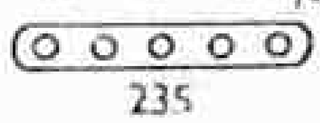
223

TRIANGULAR FLEXIBLE PLATES

		s. d.
221.	2½" × 1½"; 60 × 38 mm	/8
222.	2½" × 2" ; 60 × 50 mm	/8
223.	2½" × 2½"; 60 × 60 mm	/9
224.	3½" × 1½"; 90 × 38 mm	/8
225.	3½" × 2" ; 90 × 50 mm	/9
226.	3½" × 2½"; 90 × 60 mm	/10


230

231


235

230.	4" Rod with Keyway; 10 cm	/10
231.	Key Bolt	/3
235.	Narrow Strip, 2½" × 11/16": 60 mm × 9 mm	/6
235a.	" " 3" × 11/16": 75 mm × 9 mm	/7
235b.	" " 3½" × 11/16": 90 mm × 9 mm	/8
235d.	" " 4½" × 11/16": 115 mm × 9 mm	/8
235f.	" " 5½" × 11/16": 140 mm × 9 mm	/9

MECCANO BOOKS OF MODELS

0/1		1/3
2/3		1/9
4/5/6		4/3
7/8		6/9
9	Wallet with ten leaflets (see below†)	10/-
10	Wallet with 12 leaflets (see below‡)	15/-
Gears Book		1/3
Book of Mechanisms		1/9
Elektrikit Manual		3/6
Power Drive Manual		2/3
Junior Power Drive Manual		2/3

† No. 9 Special Model Leaflets

9/1	Fire Escape	-/9
9/2	Wharf Crane	-/9
9/3	Fork Lift Truck	-/9
9/4	Giant Dragline Excavator	-/9
9/5	High Speed Press	-/9
9/6	Bascule Bridge	-/9
9/7	Robot or Mechanical Man	-/9
9/8	Freight Plane	-/9
9/9	Car and Caravan	-/9
9/10	Articulated Lorry	-/9

‡ No. 10 Special Model Leaflets

1	Railway Service Crane	1/3
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THE EASY WAY TO LEARN

The use of Meccano as a teaching aid

WE HAVE all heard the comment, 'I wish I'd taken more notice at school' – most likely from an adult left behind in a discussion on some basic school subject. It's such a small sentence, yet it highlights one of the main problems in education: how to explain a subject to a student in such a way as to interest him enough to make him want to understand it.

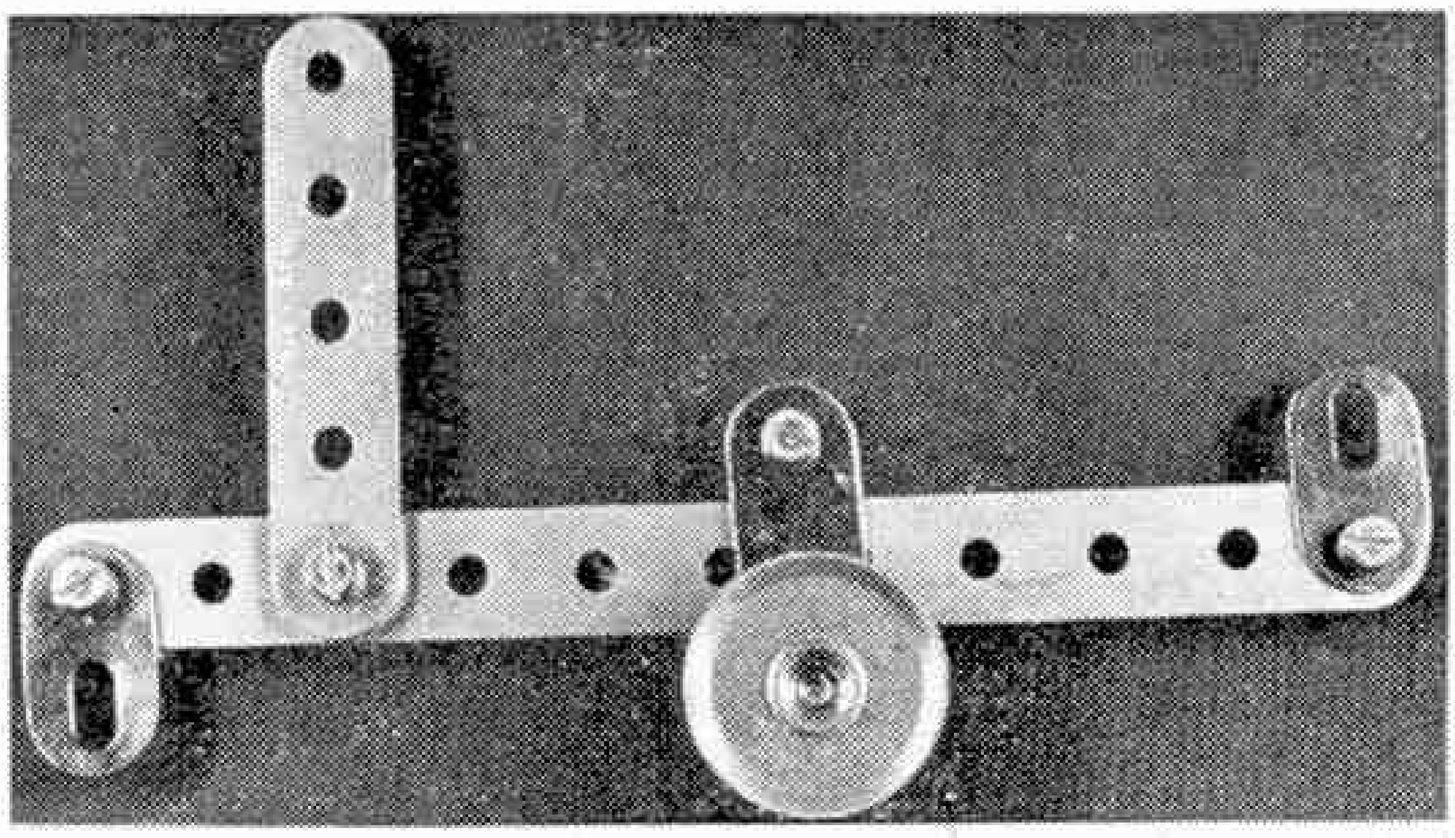
If he *wants* to learn, then the battle is almost won because he will persist until he *does* understand it and, in doing so, he will absorb and retain the knowledge so gained.

The word 'battle' here is carefully chosen. Education, at least as regards children, is a battle, as you will agree if you accept that the average child goes to school, not because he has a burning desire to learn, but because he has no choice other than to go. Once there, he is probably more interested in having a good time with his freinds than learning anything of academic value, therefore the teacher is faced with problems right from the start. He knows that it is almost impossible for a pupil to learn something he does not understand and that he will not even seriously try to understand it unless it holds his interest. Consequently, the teacher must present his subject in as interesting a way as possible, then, once the pupil's interest is captured, he must ensure that the pupil understands and so learns the subject as easily as he can.

Having thus established this fact it becomes self-evident that the Meccano systems, both plastic and metal, make perfect educational aids. With comparatively few Meccano Parts it is possible to build up simple apparatus which demonstrate various principles of mathematics, physics, mechanics and science generally. For the past 50 years, thousands of schools throughout the world have been using Meccano to illustrate such things as the Three Orders of Levers, Pulley Systems, the Triangle of Forces, the Inclined Plane, and so on.

On a more advanced level, the ability of gear trains to increase and decrease speed and power (torque) can be easily proved, thanks to the numerous Gear Wheels, Pinions, Bevels and Contrates included in the Meccano system. Then again, these Parts can be used to inject life and interest into the stark mathematics involved in working out gear ratios by constructing gearboxes which incorporate the ratios concerned. Also, the intricacies of an epicyclic gearbox become obvious with a working sample and, of course, most aspects of drive transmission can be accurately illustrated.

Quite apart from the teaching of scientific principles, Meccano is ideal for explaining, in an interesting way, the nature of many engineering constructions in everyday use, a prime example of this is the motor car which would be extremely difficult to explain without the aid of



It is an undisputed fact that one of the best ways of teaching a young pupil the basic principles of particular subjects is to use models whenever possible. Meccano therefore makes an excellent educational aid as is proved by this Roman Steelyard which illustrates the First Order of Levers.

a 3-dimensional model. With Meccano, it is possible to build an excellent reproduction of a motor car chassis incorporating all the major mechanisms contained in the original. These mechanisms can be invaluable as many children have great difficulty fully understanding the workings of something such as a differential from 2-dimensional drawings in a text-book. Let them handle a model, however, and they can immediately *see* how it works.

Many enthusiastic science teachers use even more elaborate Meccano models to help them explain their subject. An instance that comes to mind was a working model Tellurion, built by a master and boys of St. Augustine's Secondary School, Glasgow. With the aid of this model it was possible to make clear to students the scientific reasons why there are different seasons in the year; why night is followed by day; why there is an equator, etc., besides illustrating and explaining various characteristics of the earth such as the Tropics, and the long days and nights at the Poles.

Other Meccano models that have been used very effectively for educational purposes include various types of weaving looms, harmonic motion designing machines and weight-driven clocks, to mention just a few, and, on a higher educational plane still, Meccano Parts were used at one of our great Universities before the war to help originate a prototype of that most complicated of instruments – the differential analyser. This leaves no doubt that Meccano has its educational uses!

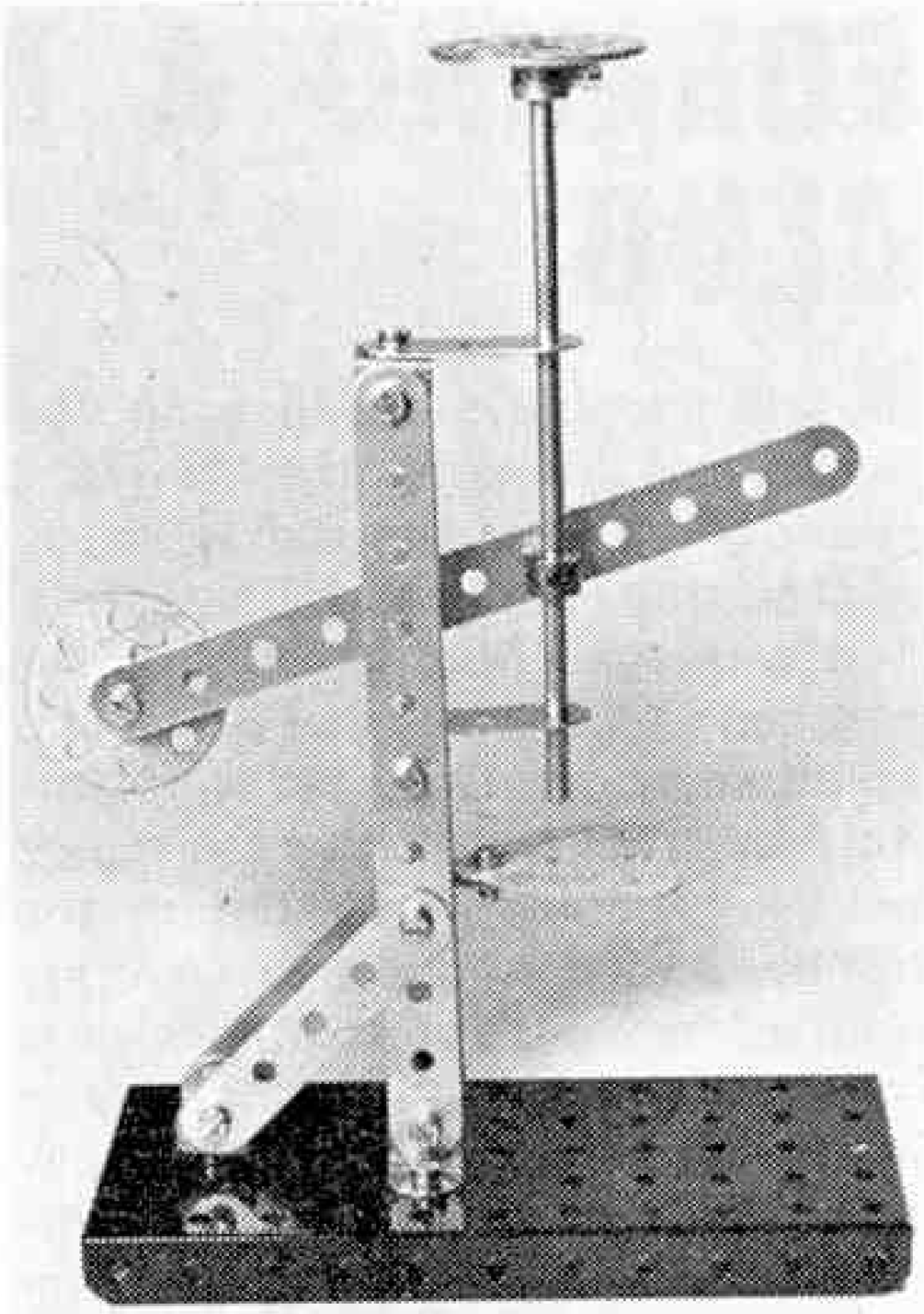
Meccano Limited, of course, are fully aware of the educational properties of their system. In fact, they are currently co-operating with the Nuffield Foundation in the development of a number of models that demonstrate various principles of science and mechanics. Most of the models have been supplied by the Foundation to selected trial schools where they are being tested under actual working conditions, any necessary changes being made in the light of classroom experience. Eventually, a whole range of models designed by Nuffield will appear as classroom aids, taking one step further the principle of 'learning through experience'.

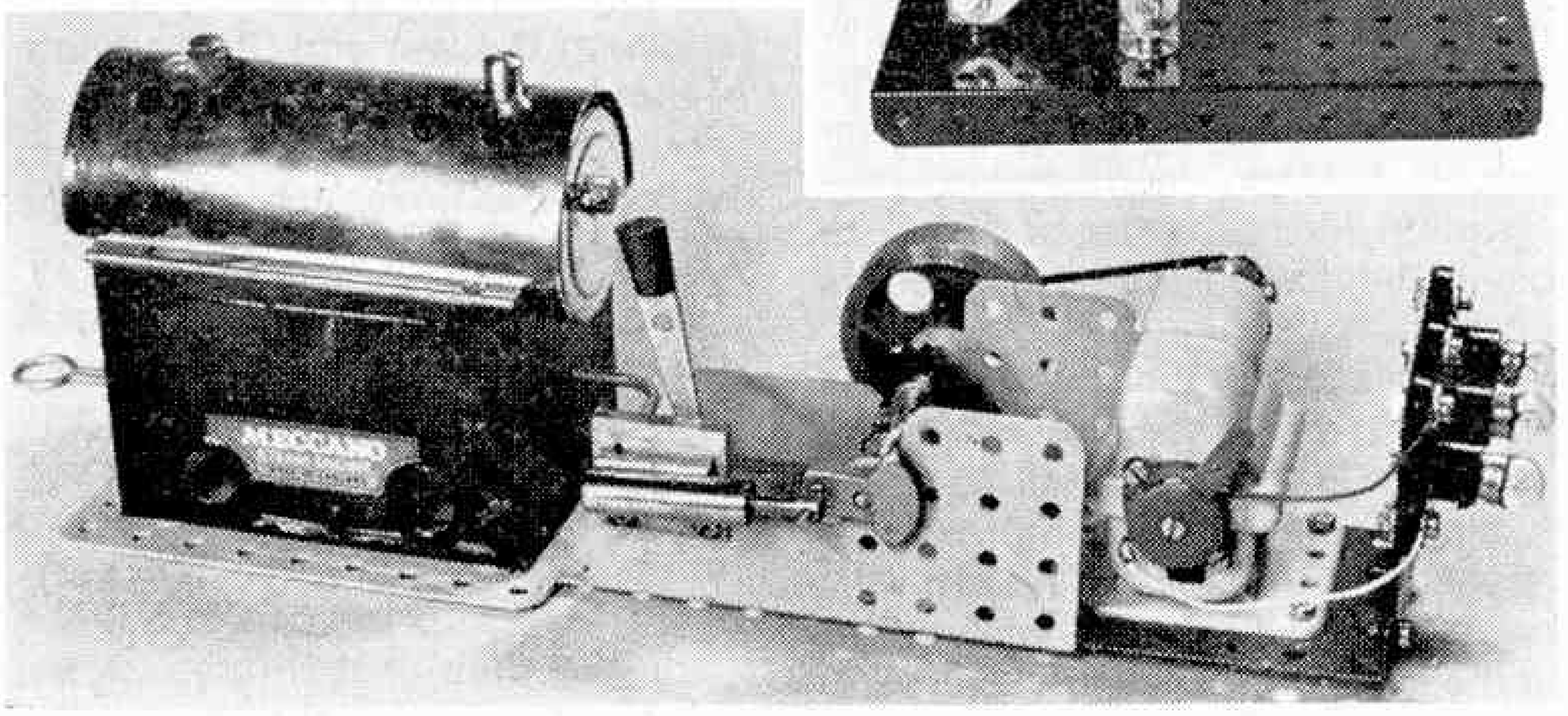
Things will not end here, either. Meccano as a company, in conjunction with Educational Productions Limited of Wakefield, Yorkshire, is developing several educational projects including a 'New Maths' system aimed at Junior School pupils up to the age of 11 years. This system will consist of several theme sets, each set dealing with a different subject and accom-

panied by instructions to build a whole variety of models. Also included will be a set of experiment cards which, between them, will provide a range of useful experiment to suit pupils of all grades.

Education, in short, is becoming more and more interesting for both pupil and teacher alike, and Meccano is in the forefront of the drive to keep the interest going.

Further examples of the educational value of Meccano are shown here. Right, a simple Hand Press illustrating the Second order of Levers and, below an Energy Conversion model showing how heat energy is converted, via a steam-driven dynamo, into light energy.





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FORMING A MECCANO CLUB

IN THE early days of Meccano, the founder of the company, Mr. Frank Hornby, realising the strong desire of Meccano enthusiasts to be identified with their hobby, founded the Meccano Guild. This was and still is an organisation dedicated to fostering friendship and mutual assistance between people interested in the hobby. and it is open to anybody with a Meccano Set no matter what their age, sex, nationality or religion might be. Upon joining, all applicants receive a membership certificate and a Guild lapel badge after paying a token membership subscription fee, currently of 1/6d., to cover the cost of the badge and its postage.

The Meccano Guild, however, has always had a drawback in that its members are scattered all over the world owing to the international appeal of the Meccano system. Because of this, the Guild, being based at the Meccano factory in Liverpool, has never been able to function as a club with private club-rooms in which members can hold meetings. To overcome this problem, therefore, Frank Hornby encouraged Guild members to get together with other members in their area and form their own local clubs, either in school or out of school, so that they could meet in an atmosphere of friendship and mutual interest.

Before the last war, these clubs were tremendously successful, hundreds being in existence and all officially affiliated to the Meccano Guild. They filled a long-felt want among boys all over the world for an interchange of ideas and communication on a host of topics of interest to youngsters of all nationalities. Throughout the 1930s they grew and flourished; right up to the start of the war when, of course, circumstances forced them to be abandoned as so many of our other fine institutions were abandoned.

With the advent of peace in 1945 Meccano went back into production and subsequently some clubs were re-formed. Sadly, however, owing to the austere conditions following the war and the later lure of that hobby-destroying invention, television, the number of Clubs in existence has never approached the pre-war situation.

Despite this, there is no reason whatsoever why new Meccano Clubs should not be formed today. There is certainly a demand for them as is proved by the large number of enthusiasts who have recently contacted Meccano Ltd., to enquire if there is a Club in their area. Some of these can be put in touch with a local Club, but those with no Club within striking distance are advised to look at the possibilities of forming their own Club. This is really not so difficult as it sounds.

How do you go about forming a Meccano Club? Well, the first thing to do is to get in touch with other people interest in the Meccano hobby and, if you do not personally know of sufficient 'candidates', this can be done in a number of ways. For younger enthusiasts the ideal source of possible members is among your fellow students at school. You could 'sound out' the students yourself, but results will be much better if you ask the head-

master either to make an announcement to the school during assembly or to put up notices regarding your proposed Club on the school notice boards. Most headmasters will be only too pleased to co-operate.

For those enthusiasts no longer at school, the problem of obtaining sufficient members is slightly more complicated. Your best course of action – if not your only course – is to advertise, and we recommend a small ad. in the personal column of your local paper or of Meccano Magazine. It need not be anything outstanding and costly; just a few words asking anybody interested in forming a Club to contact you. You'll be surprised how many keen Meccano followers there are dotted about almost any area you care to name!

Having obtained sufficient prospective members – and, to begin with, there need not be more than perhaps half-a-dozen, or so – the first thing to do is to call a general meeting to elect officials and to decide on a programme. The actual meeting place might be a problem and, here, the students would have the advantage as they could probably hold the meeting at school during the lunch break or after lessons have finished for the day. The older enthusiasts would presumably meet at somebody's home.

On the subject of officials, those necessary are the Secretary, the Treasurer and members of the Committee, the number of whom depends on the size of the Club. A reasonable guide to follow is one Committee member for every six Club members.

With the officials elected, the next thing to deal with is the programme which should, of course, be chiefly, although not exclusively, concerned with Meccano modelling. Model-building meetings can

take many forms but, in general there are two main types. In one of these, competitions are arranged, with members using their own Outfits for producing their entries. The best plan is to fix on a series of set subjects. For instance, the subject for one meeting may be cranes, for another, bridges, for a third, motor vehicles, and so on. The models for entry may be built at the meeting itself, or may be built at home by members and brought to meetings for judging or demonstration. A small prize increases interest, but the best idea is to award points, and to give prizes to members who win the largest number of points in a 'season'.

In the other main type of model meeting, members pool their resources – perhaps in groups if there are sufficient members – and with the combined equipment they build larger and more imposing models than any one of them can build separately. If possible, both kinds of model meetings should be arranged

during a season to provide variety and, in addition, quick contests of the simplicity type or of the kind in which members are given a limited number of Parts from which to produce an entry, can be included.

As a Club grows, it usually becomes possible to diversify so as to further increase variety. Sections may be formed to cover hobbies, other than Meccano, in which members are interested. Such things as aeromodelling, photography, boat-modelling, stamp collecting – even amateur dramatics – are some of the subjects that come to mind, and there are many more. Indoor games and possibly gymnastics, too, may be introduced in order to add to the programme's appeal and other plans can be made as the Club continues. All these schemes will help in developing that essential factor – the right Club spirit.

In the past, the aim of most independent Meccano Clubs has been to secure affiliation to the Meccano Guild. Affiliation is still open to any Club eligible, and the only conditions set by Meccano are that the Club (1) must have a membership of at least six (2) must have a suitable meeting place and (3) must have an adult Leader if the rest of the Club's members are younger enthusiasts.

In the last case, the Leader need not necessarily be an active builder, but is required to ensure that the Club's activities are conducted in a proper manner. He could be the parent of one of the members or could be a school teacher. The meeting place, too, need not be a specially hired or owned club room, although this would be the ideal thing, but could be a school class room or a member's house. In fact, members could take turns at holding meetings in their various houses.

To become affiliated to the Meccano Guild, the Leader of a Club should contact The Secretary, Meccano Guild, Meccano Limited, Binns Road, Liverpool 13, giving the name of the Club, the names and addresses of officials, the number of members and the address, if permanent, of the Club's meeting place. A summary of meetings held to date is also advisable. Anyone wishing to form a Meccano Club will have the full encouragement of Meccano Limited, so why don't you try it?

MECCANO—ITS ORIGIN AND HISTORY

by Norman G. Tudor

ONE OF the most outstanding and fascinating success stories in the model-engineering world this century is that of Meccano, the world's most famous constructional model-building system. The complete story would require much more space than is available to me here, but I feel sure that the following brief outline of its inventor and origin, together with a few of the more important developments of the last 60 years or so, will be of interest to all model-engineering enthusiasts.

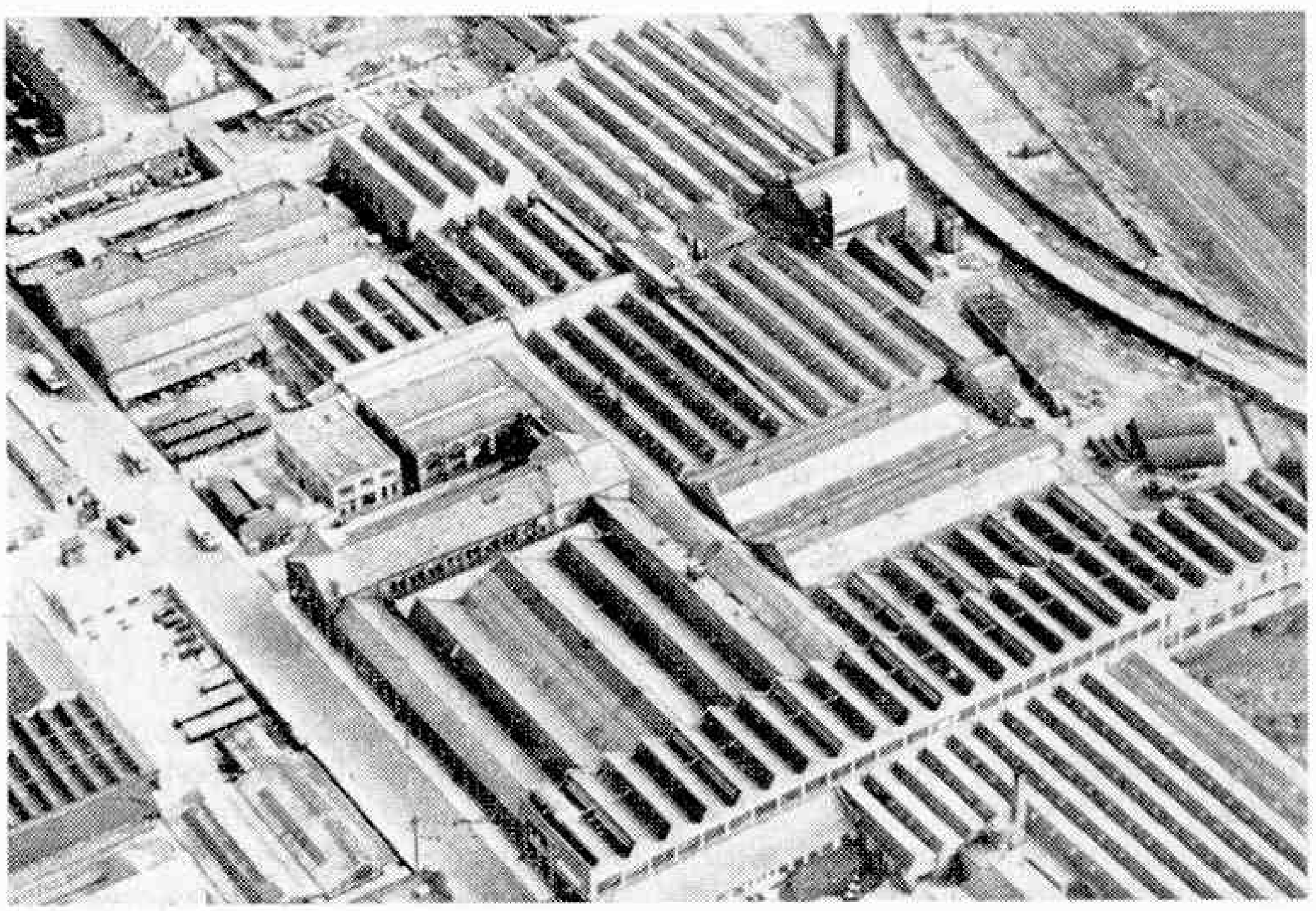
Many readers will no doubt be aware that Meccano was invented

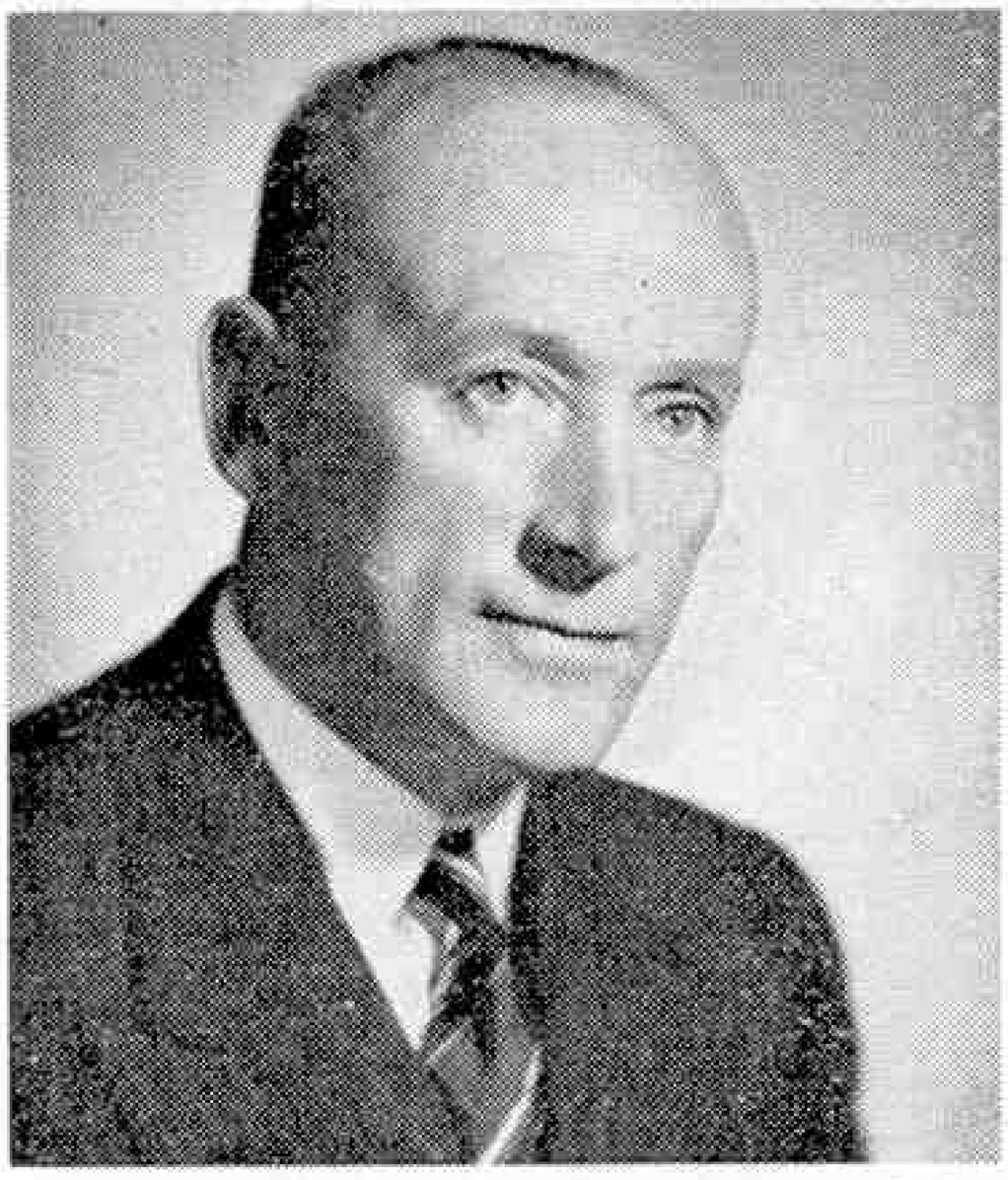
by the late Mr. Frank Hornby, who became Chairman of Meccano Ltd., Liverpool, the Company which he formed to produce and market his invention.

Born in 1863, Frank Hornby was the son of a Liverpool provision merchant. He was not the only member of the family to become famous, for he had a sister who became a well-known and fearless missionary in China, where she served and carried on her work under great danger for many years. The writer once had the pleasure of attending a tea-party at which she was present and hearing from her own lips some of her amazing experiences in the Far East. However, to get back to her brother Frank, although he had always been very interested in engineering and anything to do with mechanics, Frank was not an engineer. He was a great reader of books on engineering topics, was fond of singing for he had a good tenor voice – and was deeply interested in temperance work, being a keen supporter of the

Above, the late Mr. Frank Hornby, inventor of the Meccano model-building system and founder of Meccano Limited. Below, an aerial view of the Meccano factory in Binns Road, Liverpool taken some years ago.

Band of Hope. When he was 24 Frank went to work for a well-known firm of meat importers in Liverpool, with which he remained until he was 45. Meanwhile he had married and had two sons, Roland and Douglas. Like most men he had





The late Mr. Roland G. Hornby, son of the inventor of Meccano and chairman of the company after the death of his father.

his hobbies and to indulge his love of engineering he built himself a small workshop at his home. In this he spent most of his spare time, making simple mechanical gadgets and toys for his boys, with the simple tools available to him. At one time he was greatly attracted by the problem of perpetual motion and he spent hours trying out various ideas to find a solution to this fascinating problem. Needless to say, like many other experiments, before and since, the problem defeated him. It was his love of making toys for his children that finally led him to invent the wonderful constructional model system that ultimately became known all over the world as Meccano. Little did he know when he made the first bits and pieces that he had discovered an idea that was to bring him not only great wealth and fame, but was to be a means of bringing untold happiness to boys (and indeed girls) in practically every civilised country of the globe.

It is quite impossible in a short space to mention all the steps that led Frank Hornby to the underlying principle of perforated interchangeable components that is the basis of his Meccano system, but he was guided in his experiments by a desire to make a toy of which his children would not quickly tire. He had found that often he might spend many hours in making, say, a small truck or crane for them only to find that they, after a few days, were tired of playing with it and wanted something new. How wonderful he thought it would be, if he could make, say, a truck and then, when they tired of it, use the same pieces of wood or metal and by arranging them in some other way form perhaps a small crane or a windmill. Once this idea struck him he became fascinated by it and from then onwards, basing his experiments on his knowledge of basic engineering principles, he spent hours cutting out pieces of metal of various shapes and sizes and drilling them with small holes through which bolts could be put to fasten them one to another. At long last after many nights of patient endeavour he finally realised that an equidistant spacing of the holes in $\frac{1}{2}$ in. wide strips of metal made to various lengths would give him what he had sought for so long. Using such strips and combining them with pieces of other standard shapes each perforated on the same basis of equidistant centres, he realised his ambition and was able to assemble the parts together in almost any arrangement he wanted. Throughout his experiments Frank had been determined to base his work on sound engineering principles, with the result that the constructional system he finally produced, although intended primarily for the construction of mechanical toys, has time and again proved its value for more serious applications in the construc-

tion of real engineering models required in designing of actual engineering structures. I could quote very many examples of Meccano used for this purpose, but will have to content myself with mere mention of the fact.

It is indeed remarkable that the sizes of the various parts, the diameter of the holes and the distance between them that Frank adopted in his final experiments, have never been changed in all the years Meccano has existed, and he always regarded it as very fortunate that he hit upon what time has proved to be the best standard dimensions.

He took out his first patent on January 9th, 1901. In making his application for his British Patent he claimed that his was the original application of the basic principles of engineering to a metal constructional mechanical toy, and it was on this basis that the British Patent Office granted him his first patent. This was followed by other applications and the granting of Patents in most countries of the civilised world.

To keep the record straight, I must mention here that the name Frank Hornby gave to his model-building system when it was first put on the market was 'Mechanics Made Easy', and the shorter name 'Meccano' was not adopted until 1907, when he registered it as a trade name on 14th September of that year.

When one compares the meagre variety of parts in those first 'Mechanics Made Easy' Outfits with the vast range of over 240 precision-made interchangeable parts that comprise the present Meccano range, and thinks of the wonderfully intricate electrically - operated models that can now be built, the truly amazing progress that has been made since those early days becomes apparent and it is a source of great satisfaction to me to have been closely concerned in this development of the Meccano system.

Like many other great and successful inventions Meccano has had to face imitators, and a complete list of them would fill a book. Many of these imitations were produced in the United States of America, although blatant imitations, not only of the Meccano Parts themselves but also of the copyright models in the Meccano Instruction Books, have been produced in many other countries in all parts of the world. In the early days, soon after he took out his first patents, Frank Hornby had to take many legal actions against these imitators, and I remember one famous case in the United States that lasted over nine years and cost Meccano Ltd. many thousands of pounds before it ended in the final and complete establishment of Frank Hornby's patents, copyright in his models and Instruction Books, and other privileges.

So much for the imitators. In spite of all these efforts Meccano still reigns supreme as the world's greatest constructional-model system.

Since 1901 the story of Meccano has been one of constant and continuous development. The first 'Mechanics Made Easy' Outfits were produced in a tiny workshop, almost too small to call a factory, over shop premises in the City of Liverpool. This very soon became inadequate and a move was made to much larger premises in West Derby, Liverpool. But within a short time even this new factory proved quite unable to cope with the enormous and increasing demand for Hornby's Outfits and finally it was decided to purchase the vast factory premises in Binns Road, Old Swan, which became and has remained the home of Meccano and Headquarters of Mec-

cano Ltd. Side by side with the continuous growth of his business and manufacturing facilities Frank was constantly striving to extend the range of Meccano parts to make possible the construction of even larger and more interesting working models. All the later parts that have been introduced are of course designed on the basic principle of interchangeability. Originally all the strips, girders and other small parts were electro-plated, but to mark the 25th Anniversary of his patent in 1926, Frank Hornby decided to introduce coloured Meccano. In the new Outfits some parts were enamelled Red and others Green, while the Pulleys, Gears and certain other brass parts were lacquered.

This revolutionary change, much to many people's surprise, proved most popular and the sales of Meccano increased even more rapidly than before. A short time before the outbreak of the Second World War the colour scheme was changed to Blue and Gold. These colours had been used for some years for the Meccano Outfits produced at the French works of Meccano Ltd., in Paris, for sale in France, but they did not prove so popular in Great Britain and other countries supplied from the main Factory in Liverpool. However, before the Blue-Gold outfits had been on sale for more than a year or so, the outbreak of War in 1939 brought an end to all toy production at the Liverpool Factory for the duration of hostilities, and the entire Factory, with its finely equipped tool rooms, machine, press, die-casting and conveyor assembly departments, went over to producing highly technical electrical devices, fuses, hypodermic needles and other components required by the various War Departments and fighting services.

Nowadays Meccano is available in a colour scheme of Yellow and Black, which was introduced in 1964, and in my opinion gives the models a very engineering-like reality.

One other 'landmark' in Meccano history I would like to mention concerns the instructions books packed with the Outfits. Since the earliest years a form of book had been used in which each model was illustrated by one or two photographic half-tones accompanied by a written description of its constructional details. For small models this method is quite satisfactory, but in the case of large and complicated structures the written description becomes very lengthy and tedious to follow.

After much costly experimental work in 1959-60, therefore, a completely new scheme was adopted in which the models are not only much more adequately illustrated by means of perspective line drawings but no written description is necessary. The new style books have added still further to fun and pleasure of model-building, with the result that sales of Meccano Outfits are now at the highest peak ever.

There is so much more I could tell you of the story of Meccano since 1901 but unfortunately, space does not permit. However, I am sure that those who are now responsible for its production and future development will not be content to let the story end here.

Over the years the Model-Building staff at Meccano Ltd. have produced some really fantastic models specially for exhibition display. The giant Rocking Horse pictured right, for example, stands over 20 ft. high, is 17 ft. long and weighs more than half a ton – that is some model! Based on the emblem of the Nuremberg International Toy Fair, and built for the 18th Fair held in February 1967, it used an estimated total of 60,000 parts including 20,000 Nuts and Bolts. Believe it or not, our other picture shows models of some of the Crown Jewels, again built entirely out of Meccano, as they appeared on show at the 1954 British Industries Fair.

GIANT MECCANO MODELS

MECCANO BIG WHEEL

Centrepiece of Liverpool Corporation's annual Christmas display in Clayton Square, Liverpool City Centre last year was an enormous Meccano model of the world-famous Big Wheel in Vienna. Standing over 16 ft. high from top to bottom and brightly lit by 150 lamps, the Wheel was built entirely from over 45,000 Meccano Parts. The actual revolving wheel has a diameter of 13 ft. 7 in. and carries 15 cars mounted around its circumference. As many as 25,000 Nuts and Bolts alone were used in its construction, which lasted six weeks from start to finish

Vienna's original Big Wheel, designed by English engineer William B. Bassett, and made famous by the film 'The Third Man', was built in eight months, work finishing on June 21, 1897, although it did not start turning until 12 days later. In 1945 it was burned down and was not re-built until after the war, eventually with a total number of 15 cars, exactly half the number fitted to the original. Meccano's Big Wheel was first shown at the Nuremburg Toy Fair early in 1966 when it was one of the main attractions of the show.

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